TOSHIBA
Leading Innovation

ESTIA

A09-002

AIR TO WATER HEAT PUMP

SERVICE MANUAL

HFC
R410A

Model name:

Hydro Unit

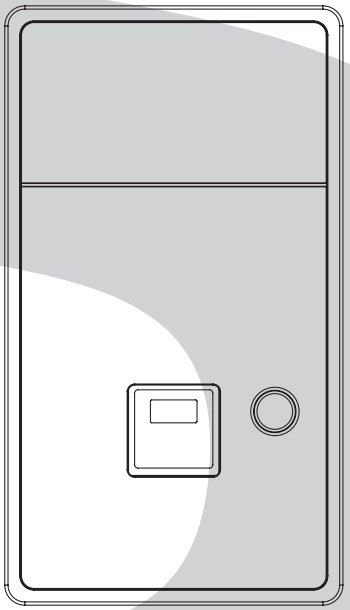
HWS-802XWHM3-E
HWS-802XWHT6-E
HWS-1402XWHM3-E
HWS-1402XWHT6-E
HWS-1402XWHT9-E

Outdoor Unit

HWS-802H-E
HWS-1102H-E
HWS-1402H-E

Hot Water Cylinder

HWS-1501CSHM3-E(-UK)
HWS-2101CSHM3-E(-UK)
HWS-3001CSHM3-E(-UK)



Contents

1 SAFETY PRECAUTIONS 3

2 NEW REFRIGERANT (R410A) 6

2-1.Safety During Installation and Service 6

2-2.Installing refrigerant pipe 7

2-2-1.Steel pipe and joint 7

2-2-2.Processing of piping materials 8

2-3.Tools 10

2-3-1.Necessary tools 10

2-4.Recharging of refrigerant 11

2-5.Brazing of pipes 13

2-5-1.Materials of brazing 13

2-5-2.Flux 13

2-5-3.Brazing 13

3 Specifications 15

4 Outside Drawing 17

4-1.Hydro unit 17

4-2.Outdoor unit 18

4-3.Hot water cylinder 20

5 Wiring Diagram 21

5-1.Hydro Unit 21

5-2.Outdoor Unit 22

5-3.Hot Water Cylinder Unit 23

6 Key Electric Component Rating 24

6-1.Hydro Unit 24

6-2.Outdoor Unit 26

6-3.Hot Water Cylinder Unit 28

6-4.Water Heat Exchange Control Board 29

6-5.Outdoor Control Board 30

7 Refrigeration Cycle / Water System Diagram 32

7-1.Water System Diagram 32

7-2.Refrigeration Cycle System Diagram 34

8 Operational Description 35

9 Method of Defect Diagnosis 64
9-1.Matters to be confirmed first 65
9-1-1.Check the power supply voltage 65
9-1-2.Check for any miswiring of the connection cables between the hydro unit and the outdoor unit 65
9-1-3.About the installation of the temperature sensor 65
9-2.Non-defective operation (program operation) ... No fault code display appears 65
9-3.Outline of the determination diagram 66
9-3-1.Procedure of defect diagnosis 66
9-3-2.How to determine from the check code on the remote control 66
9-3-3.How to cancel a check code on the remote controller 66
9-3-4.How to diagnose by error code 67
9-4.Diagnosis flow chart for each error code 74
9-4-1.Hydro unit failure detection 74
9-4-2.Outdoor Unit Failure Detection 91
9-4-3.Temperature sensor, temperature-resistance characteristic table 101
9-5.Operation check by PC board switch 102
9-5-1.Operation check mode 102
9-6.Brief method for checking the key components 103
9-6-1.Hydro unit 103
9-6-2.Outdoor unit 104
10 Hydro unit and Outdoor Unit Settings 105
11 How to Exchange Main Parts 127
12 Periodic Inspection Items 154
13 Part Exploded View, Part List 155

1 SAFETY PRECAUTIONS

The unit and this service guide list very important safety precautions.
Understand the following details (indications and symbols) before reading the body text, and follow the instructions.

[About indication]

Indication	Meaning of Indication
⚠ DANGER	**Indicates that a wrong operation may cause a service engineer and the third persons around to get fatal or serious injuries.**
⚠ WARNING	**Indicates that a wrong operation may cause a service engineer and the third persons around to get fatal or serious injuries, or that unit defective after the operation may cause a user to have a similar serious accident.**
⚠ CAUTION	**Indicates that a wrong operation may cause a service engineer and the third persons around to get injuries or may cause property damage*, or that unit defective after the operation may cause a user to have a similar accident.**

* Property damage indicates extended damage to property, furniture, livestock, or pets.

[About symbols]

Symbols	Meaning of Symbols
⊘	**Indicates a forbidden action.** **Specific forbidden actions are described in text near the symbol.**
●	**Indicates a forcible (must do) action.** **Specific forcible actions are described in text near the symbol.**
△	**Indicates a caution (including danger and warning).** **Specific cautions are described in picture or text inside or near the symbol.**

⚠ DANGER

<Turn off the power breaker>

Turn off the power breaker before removing the front panel and cabinet.

- Failure to do so may cause a high voltage electric shock, leading to death or injury.
- During an operation, the second side circuit of high pressure transmission(*) are applied with a high voltage of 230V or higher.
- Touching the circuit even with an electrical insulator, let alone a bare hand or body, causes an electric shock.

∗: For details, see the schematic.

<Discharge between terminals>

When the front panel and cabinet are removed, make short-circuit current to discharge between high pressure capacitor terminals.

- Failure to do so may cause a high voltage electric shock, leading to death or injury.
- After the power is turned off, the high pressure capacitor is still charged with high voltage.

<Forbidden>

Do not turn on the power breaker after removing the front panel cabinet.

- Failure to do so may cause a high voltage electric shock, leading to death or injury.

⚠ WARNING

<Check earth ground>

Before starting failure diagnosis or repair, check that the ground wire (∗) is connected to the unit ground terminal.

- An unconnected ground wire could cause an electric shock if electric leakage occurs.
- If the earth ground is not properly connected, ask an electrical worker for rework of the ground connection.

∗: Ground wire of class D grounding

⚠ WARNING

<No modification>

Do not modify the unit.

- Do not disassemble or modify the parts also.
- A fire, an electric shock, or an injury may occur.

<Use specified parts>

Use the specified parts (∗) when replacing them.

- Using parts other than specified ones may cause a fire or an electric shock.

∗: For details, see the parts price list.

<Keep children away from unit>

Keep any person (including children) other than service engineers away from a failure diagnosis or repairing place.

- A tool or disassembled parts may cause an injury.
- Advise the customer to keep the third persons (including children) away from the unit.

<Insulation treatment>

After connecting a cut lead with a crimp contact, discharge by facing the closed side upward.

- Connect lead wires with crimping terminals and turn the closed end upwards to avoid exposure to water.

<Watch out for fire>

Observe the following instructions when repairing the refrigerant cycle.

(1) Watch out for surrounding fire. Always put out the fire of stove burner or other devices before starting the repair.
Should the fire fail to be put out, the oil mixed with refrigerant gas could catch fire.

(2) Do no use a welder in a closed room.
A room with no ventilation may cause carbon monoxide poisoning.

(3) Keep away flammable materials.
The materials may catch the fire of a welder.

<Use refrigerant carefully>

Check the refrigerant name to use the tools and members appropriate for the refrigerant.

- A product using the refrigerant R410A has the refrigerant name prominently displayed on its outdoor unit. In addition, the diameter of the service port is changed from that of the conventional R22 to prevent incorrect filling.

Never use refrigerant other than R410A for Air to Water Heat Pump using R410A. Also, never use R410A for Air to Water Heat Pump using other refrigerant (such as R22).

- A mixture of R410A with different ones excessively raises the pressure in the refrigerant cycle, leading to an injury due to burst.

Do not make additional charge of the refrigerant.

- An additional charge when refrigerant gas leaks changes the refrigerant composition in the refrigerant cycle, causing the characteristics change of the Air to Water Heat Pump or excessive high pressure in the refrigerant cycle with more than the specified amount of refrigerant charged. This may cause burst or an injury. If the refrigerant gas leaks, perform refrigerant recovery or other operation to make the Air to Water Heat Pump contain no refrigerant, and then perform vacuuming. After that, refill the unit with the defined amount of liquid refrigerant. Never charge refrigerant exceeding the amount specified.

When the refrigerant cycle is refilled with refrigerant, do not enter air or refrigerants other than the specified refrigerant, R410A.

- A mixture of R410A with air or an inappropriate substance causes excessive high pressure inside the refrigerant cycle, leading to an injury due to burst.

Check that there is no refrigerant gas leak after the installation is completed.

- If it catches fire of a fan heater, a space heater, or a stove, poisonous gases may be produced.

<Be careful with wiring>

After a repair is completed, be sure to reassemble the parts and put the wiring back to its original state. In addition, be careful with the internal wiring not to be caught in a cabinet or panel.

- A defective assembly or wiring may cause a disaster at a customer site due to electrical leakage or a fire.

<Check for water leak>

After the repair of a water pathway is completed, check that there is no water leak.

- In using the product, water leak may cause a fire at a customer site due to electrical leakage or an electric shock.

⚠ WARNING

<Check insulation>

After the work is completed, check with an insulating-resistance tester (500V) that the insulation resistance between the live and dead-metal parts is 2 MΩ or higher.

- A low insulation resistance may cause a disaster at a customer site due to electrical leakage or an electric shock.

<Ventilate>

Ventilate if refrigerant gas leaks during service work.

- Should refrigerant gas catch fire, poisonous gases may be produced. A closed room full of leaking refrigerant results in the absence of oxygen; it is dangerous. Make sure to ventilate.

<Caution: electric shock>

When checking a circuit while energized if necessary, use rubber gloves not to contact the live part.

- Contact with the live part may cause an electric shock.
- The unit contains high-voltage circuits. Contact with a part in the control board with your bare hand may cause an electric shock. Take enough care to check circuits.

<Turn off the power breaker>

Because the electrical components are energized with high voltage, always turn off the power breaker before starting to work.

- Failure to do so may cause an electric shock.

<Always do>

Should refrigerant gas leak, find where the gas leaks and properly repair it.

- To stop the repair work because the leakage location cannot be identified, perform refrigerant recovery and close the service valve. Failure to do so may cause the refrigerant gas to leak in a room. Although refrigerant gas alone is harmless, if it catches fire of a fan heater, a space heater, or a stove, poisonous gases may be produced.

When installing the unit or re-installing it after relocation, follow the installation guide for proper operation.

- A defective installation may cause a refrigerant cycle defective, a water leak, an electric shock, or a fire.

<Check after repair>

After a repair is completed, check for any abnormality.

- Failure to do so may cause a fire, an electric shock, or an injury.
- Turn off the power breaker to perform check.

After a repair is completed (and the front panel and cabinet are placed), make a test run to check for any abnormality such as smoke or abnormal sound.

- Failure to do so may cause a fire or an electric shock. Place the front panel and cabinet before making a test run.

<Check after re-installation>

Check that the following are properly performed after re-installation.

(1) The ground wire is properly connected.
(2) The installation is stable without any tilt or wobbles.
Failure to check them may cause a fire, an electric shock, or an injury.

⚠ CAUTION

<Wear gloves>

Wear gloves (∗) when performing repair.

- Failure to do so may cause an injury when accidentally contacting the parts.

∗: Thick gloves such as cotton work gloves

<Cooling check>

Perform service work when the unit becomes cool enough after the operation.

- High temperature of compressor piping or other equipment after a cooling or heating operation may cause burn.

<Tighten with torque wrench>

Tighten a flare nut with a torque wrench in the specified method.

- A flare nut tightened too much might crack after a long period, causing refrigerant leak.

2 NEW REFRIGERANT (R410A)

This Air to Water Heat Pump adopts a new refrigerant HFC (R410A) to prevent destruction of the ozone layer. The working pressure of R410A refrigerant is 1.6 times higher than that of the conventional refrigerant R22.The refrigerant oil is also changed for the new refrigeration. Therefore, during installation or service work, be sure that water, dust, former refrigerant, or refrigeration machine oil does not enter the refrigerant cycle of the new type refrigerant Air to Water Heat Pump. A wrong installation or service operation may cause a serious accident. Read carefully the following instructions to use the tools or members for R410A for safety work.

2-1. Safety During Installation and Service

- Use only the refrigerant R410A for Air to Water Heat Pump using R410A.
  A mixture of R410A with different ones excessively raises the pressure in a refrigerant cycle, leading to an injury due to burst.
- Check the refrigerant name to use the tools and members appropriate for the refrigerant.
  A product using the refrigerant R410A has the refrigerant name prominently displayed on its outdoor unit. In addition, the diameter of the service port is changed from that of the conventional R22 to prevent incorrect filling.
- Ventilate if refrigerant gas leaks during service work.
  Should refrigerant gas catch fire, poisonous gases may be produced. A closed room full of leaking refrigerant results in the absence of oxygen; it is dangerous. Make sure to ventilate.
- When the refrigerant cycle is refilled with refrigerant, do not mix air or refrigerants other than the specified refrigerant, R410A.
  A mixture of R410A with air or an inappropriate substance causes excessive high pressure inside the refrigerant cycle, leading to an injury due to burst.
- Check that no refrigerant gas leaks after the installation is completed.
  Should a refrigerant gas leak in a room and catch fire, poisonous gases may be produced.
- When installing the unit that contains large amount of refrigerant such as Air to Water Heat Pump, take measures to prevent the refrigerant from exceeding the threshold concentration in case it leaks.
  Should leaking refrigerant exceed the threshold concentration could cause an accident due to oxygen deficient.
- When installing the unit or re-installing it after relocation, follow the installation guide for proper operation.
  A defective installation may cause a refrigerant cycle defective, a water leak, an electric shock, or a fire.
- Do not modify the product. Do not disassemble or modify the parts also.
  A fire, an electric shock, or an injury may occur.

2-2. Installing refrigerant pipe

2-2-1. Steel pipe and joint

For refrigerant piping, steel pipe and joints are mainly used. Select those comply with JIS (Japanese Industrial Standards) for a service work. Also, use such clean piping materials that less impurities attach to the inside of pipe and joints.

Copper pipe

Use copper pipe of the “copper and copper alloy seamless pipe” type with attach oil quantity of 40 mg / 10 m or less.
Do not use pipe that is cracked, distorted, or discolored (especially inside).The expansion valve or capillary may get clogged with impurities.
Considering that Air to Water Heat Pump using R410A is higher in pressure than those using the conventional R22, be sure to select the material that comply with the standard.
Table 2-1 shows the thickness of copper pipe used for R410A.
Never use commercially available thin-walled copper pipe of 0.8 mm thick or less.

Table 2-1 Wall thickness of copper pipe

		Wall thickness (mm)
Nominal diameter	**Outer diameter**	**R410A**
3/8	9.52	0.80
5/8	15.88	1.00

Joints

For the joint of copper pipe, flared joint and socket joint are used. Remove impurities from a joint before using it.

- **Flared joint**
  A flared joint cannot be used for the copper pipe whose outer diameter is 20 mm or larger. A socket joint can be used instead in that case.
  Table 2-2-3 and 2-2-4 show the dimensions of flare pipe, the end of flared joint, and flare nuts.
- **Socket joint**
  A socket joint is used to connect the thick-walled pipe of mainly 20 mm or larger in diameter.
  Table 2-2 shows the wall thickness of socket joints.

Table 2-2 The minimum wall thickness of socket joints

Nominal diameter	Reference of outer diameter of copper pipe connected (mm)	Minimum joint wall thickness (mm)
3/8	9.52	0.80
5/8	15.9	1.00

2-2-2. Processing of piping materials

When installing refrigerant pipe, prevent water or dust from entering the pipe, and do not use oil other than lubricant used for Air to Water Heat Pump. Make sure that no refrigerant leak occurs.
If piping needs lubrication, use lubricating oil whose water content is removed.
After the oil is put in, be sure to seal the container with airproof cover or other covers.

Flare and precautions

1) **Cut a pipe.**
   Cut slowly with a pipe cutter so that the pipe is not distorted.
2) **Remove burr and flaw.**
   A burr or flaw in a flare part may cause refrigerant leak. Remove carefully all the burrs, and clean up the cut ends before installation.
3) **Insert a flare nut.**
4) **Flare**
   Check that the clasps and copper pipe are clean. Flare correctly using the clasp. Use a flare tool for R410A or the conventional one. Flare processing dimension varies depending on the flare tool type. When using the conventional flare tool, use a gauge for size adjustment to secure the A dimension.

Figure 2-2-1
Flare dimension

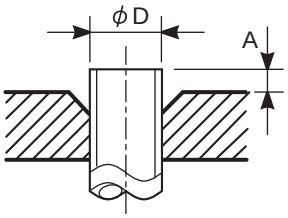


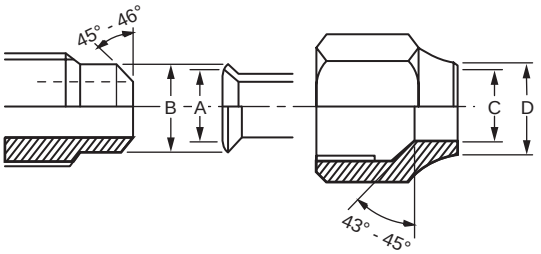
Table 2-2-3 Flare processing related dimension for R410A

Nominal diameter	Outer diameter (mm)	Wall thickness (mm)	A (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Butterfly-nut type
3/8	9.52	0.8	0 to 0.5	1.0 to 1.5	2.0 to 2.5
5/8	15.9	1.0	0 to 0.5	1.0 to 1.5	2.0 to 2.5

Table 2-2-4 Dimension of flare for R410A and flare nut

Nominal diameter	Outer diameter (mm)	Wall thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
3/8	9.52	0.8	13.0	13.2	9.7	20	18
5/8	15.9	1.0	19.1	19.7	15.9	24.5	26

Figure 2-2-2 Relationship between flare nut and flare surface



Flare connecting procedure and precautions

1) Make sure that the flare and connecting portions do not have any flaw and dust.
2) Correctly align the flared surface and the connecting axis.
3) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for the conventional R22. If the torque is weak, gas leakage may occur. If it is too strong, the flare nut may crack and may be made non-removable. When choosing the tightening toque, comply with values designated by products. Table 2-2-5 shows reference values.

NOTE

When applying oil to the flare surface, be sure to use oil designated by the product. Using any other oil deteriorates the lubricating oil, possibly causing the compressor to burn out.

Table 2-2-5 Tightening torque of flare for R410A (Reference values)

Nominal diameter	Outer diameter (mm)	Tightening torque N•m (kgf•m)
3/8	9.52	33 to 42 (3.3 to 14.2)
5/8	15.9	66 to 82 (6.8 to 8.2)

2-3. Tools

2-3-1. Necessary tools

In Air to Water Heat Pump using R410A, the service port diameter of packed valve of the outdoor unit is changed to prevent mixing of other refrigerant. To reinforce the pressure resistance, flare dimensions and opposite side dimensions of flare nut (For Ø 12.7 copper pipe) of the refrigerant piping are lengthened.
Because the refrigerating machine oil is changed, mixing of oil may generate sludge, clog capillary, or cause other problems. Accordingly, the tools to be used include:

- tools dedicated for R410A (Those that cannot be used for the conventional refrigerant, R22)
- tools dedicated for R410A, but can be also used for the conventional refrigerant, R22
- tools that can be used for the conventional refrigerant, R22.
  The following table shows the tools dedicated for R410A and their interchangeability.

Tools dedicated for R410A (The following tools must be for R410A)

Tools whose specifications are changed for R410A and their interchangeability

No.	Tool to be used	Usage	R410A Air to Water Hear Pump installation		Conventional refrigerant Air to Water Heat Pump installation
			For R410A Existence of new equipment	Conventional equipment can be used	New equipment can be used with conventional refrigerant
1	Flare tool	Pipe flaring	Yes	*(Note 1)	Yes
2	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	*(Note 1)	*(Note 1)
3	Torque wrench (For Ø15.9)	Connection of flare nut	Yes	No	No
4	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	No	No
5	Charge hose				
6	Vacuum pump adapter	Vacuum evacuating	Yes	No	Yes
7	Electrical balance for refrigerant charging	Refrigerant charge	Yes	No	Yes
8	Refrigerant cylinder	Refrigerant charge	Yes	No	No
9	Leakage detector	Gas leakage check	Yes	No	Yes
10	Charging cylinder	Refrigerant charge	*(Note 2)	No	No

* **(Note 1)** Flaring for R410A by using the conventional flare tool requires projection margin adjustment. This adjustment requires copper pipe gauge or other instrument.

* **(Note 2)** A charging cylinder for R410A is currently under development.

General tools (Conventional tools are available)

In addition to the above dedicated tools, the following equipment also available for R22 is necessary as the general tools.

1. Vacuum pump
   Use this by attaching vacuum pump adapter.
2. Torque wrench (For Ø6.35)
3. Pipe cutter
4. Reamer
5. Pipe bender
6. Level vial
7. Screwdriver (+, –)
8. Spanner or Monkey wrench
9. Hole core drill (Ø65)
10. Hexagon wrench
    (Opposite side 4mm)
11. Tape measure
12. Metal saw

Also prepare the following equipment for other work methods or run check.

1. Clamp meter
2. Thermometer
3. Insulation resistance meter
4. Electroscope

2-4. Recharging of refrigerant

Recharge, if necessary, the specified amount of new refrigerant according to the following procedure.

Recover the refrigerant, and check that no refrigerant remains in the refrigerant cycle.

↓

Connect the charge hose to packed valve service port on the outdoor unit's gas side.

↓

Connect the charge hose to the vacuum pump adapter.

↓

Open fully both packed valves on the liquid and gas sides.

↓

Open fully the handle of gauge manifold Lo, turn on the vacuum pump, and then perform vacuum evacuating.

↓

When the compound gauge's pointer indicates -0.1 MPa (-76cmHg), close fully the handle Lo and turn off the vacuum pump.

↓

Let the equipment stay as it is for one to two minutes and check that the compound gauge pointer does not return.

↓

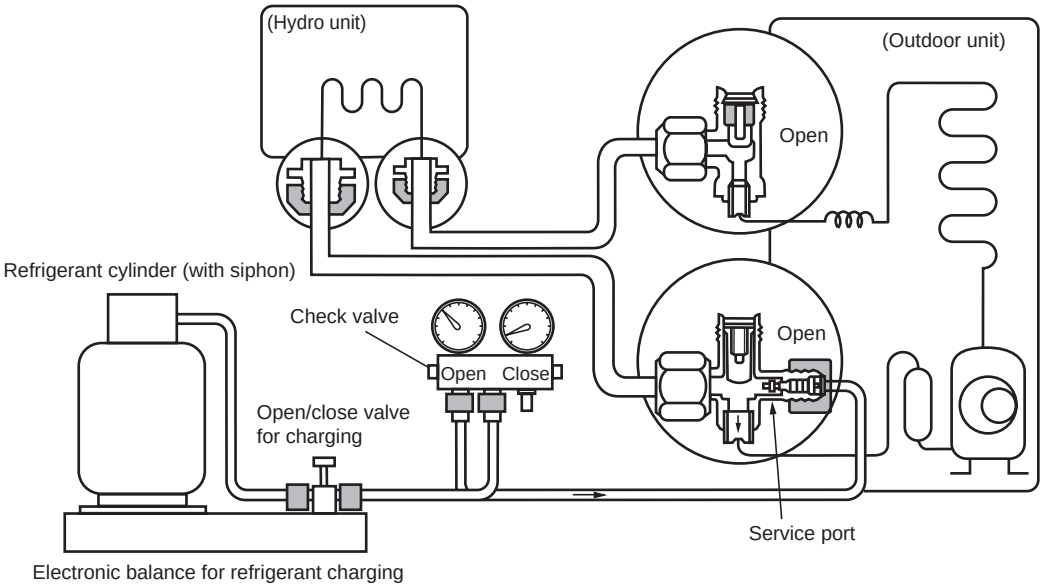
Place the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and then charge liquid refrigerant.

(For refrigerant charging, see the figure below)

NOTE

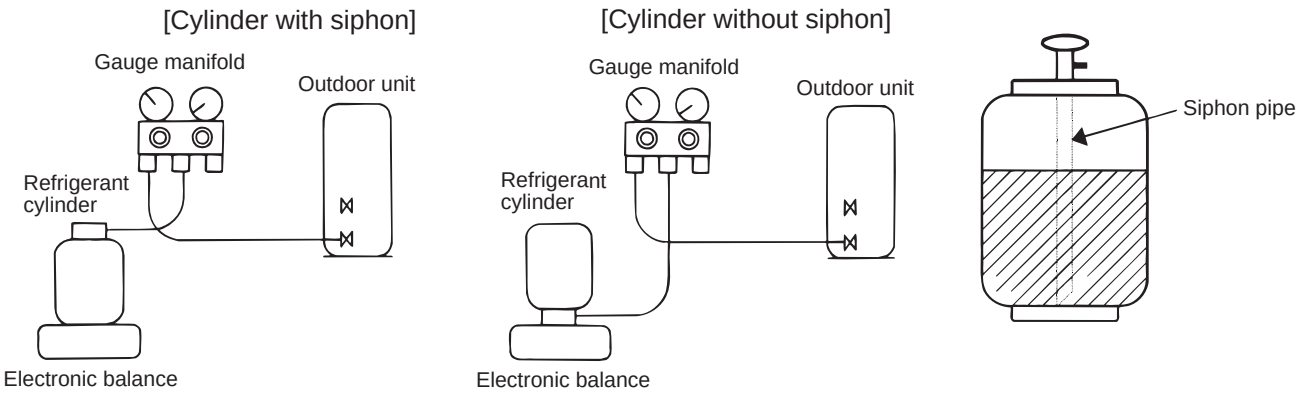
- Never charge refrigerant exceeding the specified amount.
- If the specified amount of refrigerant cannot be charged, charge it a little at a time while running refrigerant recovery (pump down).
- Do not make additional charging.
  An additional charge when refrigerant leaks changes the refrigerant composition in the refrigerant cycle, causing the characteristics change of the Air to Water Heat Pump or excessive high pressure in the refrigerant cycle with more than the specified amount of refrigerant charged. This may cause burst or an injury.

Fig. 2-4-1 Configuration of refrigerant charging



NOTE

- Make sure that the setting is appropriate so that liquid can be charged.
- A cylinder with siphon enables liquid to be charged without the cylinder turned upside down.



NOTE

- Because R410A is HFC mixed refrigerant, charging with gas changes the charged refrigerant composition, causing the equipment characteristics to change.

2-5. Brazing of pipes

2-5-1. Materials of brazing

Silver brazing metal

Silver brazing metal is an alloy mainly composed of silver and copper.
It uses iron, copper, or copper alloy, and is relatively expensive though it excels in soldering.

Phosphor bronze brazing metal

Phosphor bronze brazing metal is generally used to join copper or copper alloy.

Low temperature brazing metal

Low temperature brazing metal is generally called solder, and is an alloy of tin and lead. Do not use it for refrigerant piping because its adhesive capacity is low.

NOTE

- Phosphor bronze brazing metal tends to react with sulfur, producing a fragile compound water solution. This may cause gas leakage. Therefore, use other type of brazing metal at a hot spring resort or similar place, and coat the surface with coatings.
- To braze the pipe again while performing service work, use the same type of brazing metal.

2-5-2. Flux

Why flux is necessary

- Removing all the oxide film and any foreign matter on the metal surface assists the flow of brazing metal.
- Flux prevents the metal surface from being oxidized in the course of brazing.
- Reducing the brazing metal's surface tension enables the brazing metal to adhere for better metal processing.

Characteristics of flux

- The activation temperature of flux matches the brazing temperature.
- A wide effective temperature range makes flux hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing metal is minimum.
- The good performance of flux gives no harm to a human body.
  Since flux works in a complicated manner as described above, select an appropriate type of flux according to metal treatment type, brazing metal and brazing method, or other conditions.

Type of flux

- Non-corrosive flux
  It is generally a compound of borax and boric acid. It is effective when brazing temperature is higher than 800 °C.
- Active solvent
  Most of this type of flux is generally used for silver brazing.
  It features the increase of oxide film while moving the capability to the borax-boric acid compound to add compounds such as potassium fluoride, potassium chloride, or sodium fluoride.

Piping materials for brazing and brazing metal / flux

Piping material	Brazing metal to be used	Flux to be used
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapour flux

NOTE

- Do not enter flux into the refrigerant cycle.
- If chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Because of this, use a flux that does not contain chlorine.
- When adding water to the flux, use water that does not contains chlorine. (e.g. distilled water or ion-exchange water)
- Remove the flux after brazing.

2-5-3. Brazing

Brazing must be performed by a person qualified and experienced with theoretical knowledge since the operation requires sophisticated techniques.
Perform brazing while flowing dry nitrogen gas (N2) to prevent oxide film from forming during brazing application to the inside of the pipe.

NOTE

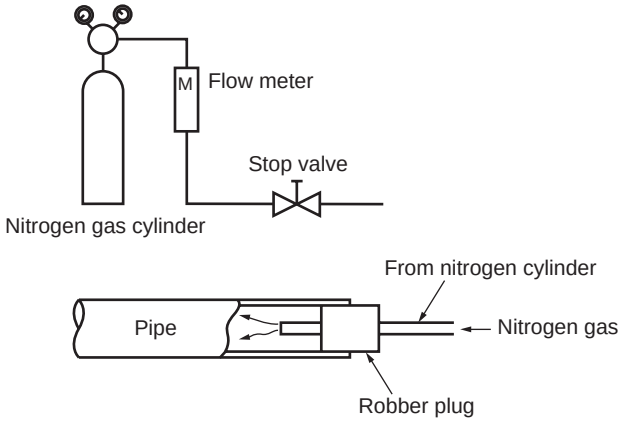
- Never use gas other than nitrogen gas.

Brazing method to prevent oxidation

1) Attach a reducing valve and a flow meter to the nitrogen cylinder.
2) Use a copper pipe to direct the piping material, and attach the flow meter to the balance.
3) Apply a mark to the clearance between the piping material and the copper pipe filled with nitrogen to prevent the back flow of the nitrogen gas.
4) If the nitrogen gas flows out, be sure to keep open the piping end.

5) Use the reducing valve to adjust the nitrogen gas flow speed to 0.05 m^3/hour or 0.02 MPa (0.2 kgf/cm^2).
6) After the steps above, keep the nitrogen gas flowing until the pipe cools down to a certain extent. (Temperature where the pipe is cool enough to be touched by hands)
7) Remove the flux completely after brazing.

Fig 2-5-1
Prevention of oxidation during brazing



3 Specifications

Unit name	Hydro unit		HWS-802XWHM3-E, 802XWHT6-E	
	Outdoor unit		HWS-802H-E	
Heating capacity *1 (kW)			8.0	
Cooling capacity *2 (kW)			6.0	
Variable range of compressor frequency			10 - 70 Hz	
Power source			Single phase 50Hz 230V	
Operation mode			Heating	Cooling
Electric characteristic *1 *2	Hydro unit	Current (A)	0.98	0.46
		Power (kW)	0.101	0.097
		Power factor (%)	91.5	91.7
	Outdoor unit	Current (A)	8.26	8.90
		Power (kW)	1.859	2.033
		Power factor (%)	97.8	99.3
	Total	Starting current (A)	9.24	9.36
Operating noise *1 *2 *4	Hydro unit (dB(A))		29	29
	Outdoor unit (dB(A))		49	49
Coefficient of performance *1 *2			4.08	2.82
Hydro unit	Outer dimension	Height (mm)	925	
		Width (mm)	525	
		Depth (mm)	355	
	Net weight (kg)		50	
	Color		Silky shade (Munsell 1Y8.5/0.5)	
	Remote controller Outer dimension *3	Height (mm)	120	
		Width (mm)	120	
		Depth (mm)	20	
	Circulating pump	Motor output (W)	125 (MAX)	
		Flow rate (L/min)	22.9	17.2
		Type	Non-self-suction centrifugal pump	
	Heat exchanger		Plate-type heat exchange	
Outdoor unit	Outer dimension	Height (mm)	890	
		Width (mm)	900	
		Depth (mm)	320	
	Net weight (kg)		63	
	Color		Silky shade (Munsell 1Y8.5/0.5)	
	Compressor	Motor output (W)	1400	
		Type	Twin rotary type with DC-inverter variable speed control	
		Model	DA220A2F-22L	
	Fan motor	Standard air capacity (m^3/min)	50.0	
		Motor output (W)	60	
Refrigerant piping	Connection method		Flare connection	
	Hydro unit	Liquid	Ø9.52	
		Gas	Ø15.9	
	Outdoor unit	Liquid	Ø9.52	
		Gas	Ø15.9	
	Maximum length (m)		30	
	Maximum chargeless length (m)		30	
	Maximum height difference (m)		±30	
	Minimum length (m)		5	
Refrigerant	Refrigerant name		R410A	
	Charge amount (kg)		1.8	
Water piping	Pipe diameter		R1 1/4	
	Maximum length (m)		None (Need the flow rate 17.5ℓ/min or more)	
	Maximum height difference (m)		±7	
	Maximum working water pressure (kPa)		300	
Operating temperature range	Hydro unit (°C)		5-32	
	Outdoor unit (°C)		-20-43	
Operating humidity range	Hydro unit (%)		15-85	
	Outdoor unit (%)		15-100	
Wiring connection	Power wiring		3 wires: including ground line (Outdoor unit)	
	Connecting line		4 wires: including ground line	

*1 Heating performance measurement conditions: outside air temperature 7 or 6 °C, water supply temperature 30 °C, outlet temperature 35 °C, refrigerant piping length 7.5 m (no height difference), capacity ≧ 97%, COP ≧ 95%, operating noise ≦ +3 dB
*2 Cooling performance measurement conditions: outside air temperature 35 °C, water supply temperature 12 °C, outlet temperature 7 °C, refrigerant piping length 7.5 m (no height difference), capacity ≧ 97%, COP ≧ 95%, operating noise ≦ +3 dB
*3 • The remote controller should be shipped with the hydro unit.
• Use two 1.5-meter wires to connect the hydro unit with the remote controller.
*4 The outdoor unit operating noise is measured at the point of 1m away from the unit back surface center and 1m high from the ground. The hydro unit operating noise is measured at the point of 1m away from the unit front surface center.
The value of the operating noise varies depending on room structure where the unit is installed.
*5 Do not leave the hydro unit at 5 °C or below.
*6 Check the water piping for leakage under the maximum operating pressure.

Unit name	Hydro unit		HWS-1402XWHM3-E, 1402XWHT6-E, 1402XWHT9-E			
	Outdoor unit		HWS-1102H-E		HWS-1402H-E	
Heating capacity *1 (kW)			11.2		14.0	
Cooling capacity *2 (kW)			10.0		11.0	
Variable range of compressor frequency			10 - 60Hz		10 - 70 Hz	
Power source			Single phase 50Hz 230V			
Operation mode			Heating	Cooling	Heating	Cooling
Electric characteristic *1 *2	Hydro unit	Current (A)	0.63	0.61	0.67	0.63
		Power (kW)	0.135	0.130	0.145	0.135
		Power factor (%)	93.2	92.7	94.0	93.2
	Outdoor unit	Current (A)	10.14	14.88	13.57	17.47
		Power (kW)	2.265	3.39	3.005	3.945
		Power factor (%)	96.9	99.1	96.4	98.1
	Total	Starting current (A)	10.77	15.49	14.24	18.10
Operating noise *1 *2 *4	Hydro unit (dB(A))		29	29	29	29
	Outdoor unit (dB(A))		49	49	51	51
Coefficient of performance *1 *2			4.66	2.84	4.45	2.69
Hydro unit	Outer dimension	Height (mm)	925			
		Width (mm)	525			
		Depth (mm)	355			
	Net weight (kg)		54			
	Color		Silky shade (Munsell 1Y8.5/0.5)			
	Remote controller Outer dimension *3	Height (mm)	120			
		Width (mm)	120			
		Depth (mm)	20			
	Circulating pump	Motor output (W)	190 (MAX)			
		Flow rate (L/min)	32.1	28.9	40.1	31.5
		Type	Non-self-suction centrifugal pump			
	Heat exchanger		Plate-type heat exchange			
Outdoor unit	Outer dimension	Height (mm)	1340			
		Width (mm)	900			
		Depth (mm)	320			
	Net weight (kg)		90			
	Color		Silky shade (Munsell 1Y8.5/0.5)			
	Compressor	Motor output (W)	2500			
		Type	Twin rotary type with DC-inverter variable speed control			
		Model	DA422A3F-25M			
	Fan motor	Standard air capacity (m^3/min)	103.0			
		Motor output (W)	100 × 2			
Refrigerant piping	Connection method		Flare connection			
	Hydro unit	Liquid	Ø9.52			
		Gas	Ø15.9			
	Outdoor unit	Liquid	Ø9.52			
		Gas	Ø15.9			
	Maximum length (m)		30			
	Maximum chargeless length (m)		30			
	Maximum height difference (m)		±30			
	Minimum length (m)		3			
Refrigerant	Refrigerant name		R410A			
	Charge amount (kg)		2.7			
Water piping	Pipe diameter		R1 1/4			
	Maximum length (m)		None (Need the flow rate 13ℓ/min or more)			
	Maximum height difference (m)		±7			
	Maximum working water pressure (kPa)		300			
Operating temperature range	Hydro unit (°C)		5-32			
	Outdoor unit (°C)		-20-43			
Operating humidity range	Hydro unit (%)		15-85			
	Outdoor unit (%)		15-100			
Wiring connection	Power wiring		3 wires: including ground line (Outdoor unit)			
	Connecting line		4 wires: including ground line			

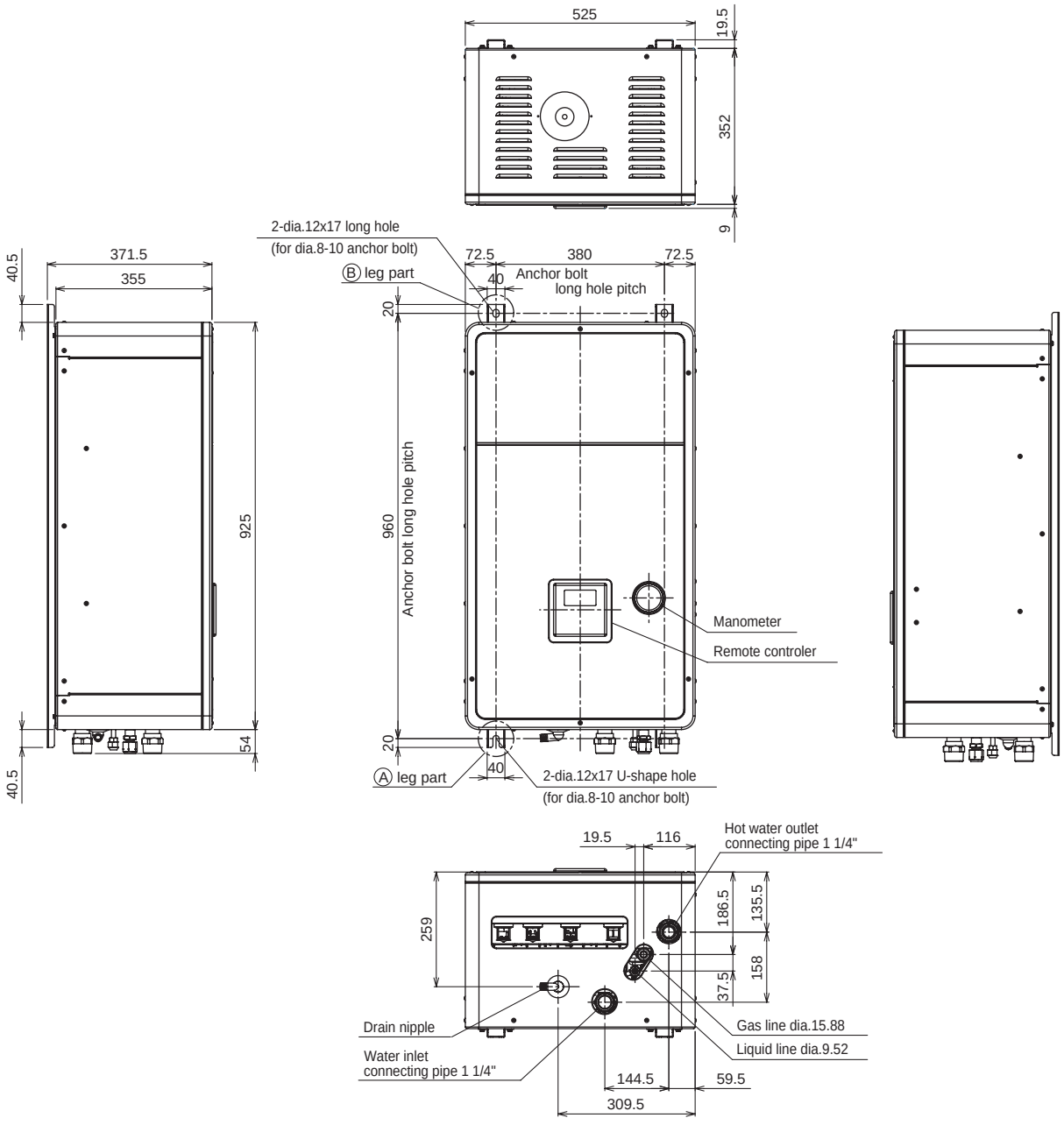
*1 Heating performance measurement conditions: outside air temperature 7 or 6 °C, water supply temperature 30 °C, outlet temperature 35 °C, refrigerant piping length 7.5 m (no height difference), capacity ≧ 97%, COP ≧ 95%, operating noise ≦ +3 dB
*2 Cooling performance measurement conditions: outside air temperature 35 °C, water supply temperature 12 °C, outlet temperature 7 °C, refrigerant piping length 7.5 m (no height difference), capacity ≧ 97%, COP ≧ 95%, operating noise ≦ +3 dB
*3 • The remote controller should be shipped with the hydro unit.
• Use two 1.5-meter wires to connect the hydro unit with the remote controller.
*4 The outdoor unit operating noise is measured at the point of 1m away from the unit back surface center and 1m high from the ground. The hydro unit operating noise is measured at the point of 1m away from the unit front surface center.
The value of the operating noise varies depending on room structure where the unit is installed.
*5 Do not leave the hydro unit at 5 °C or below.
*6 Check the water piping for leakage under the maximum operating pressure.

4 Outside Drawing

4-1. Hydro unit

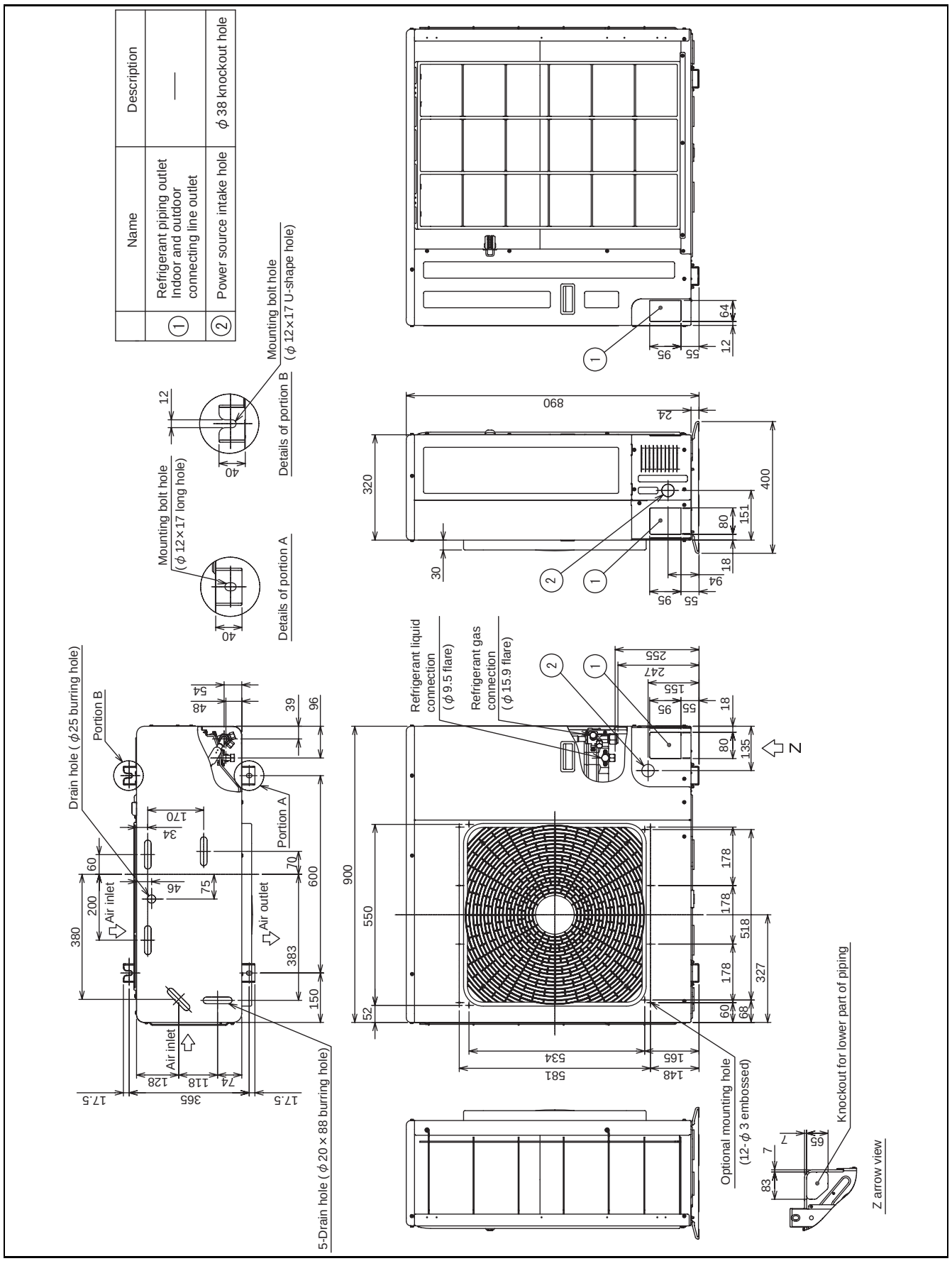
HWS-802XWHM3-E, 802XWHT6-E

HWS-1402XWHM3-E, 1402XWHT6-E, 1402XWHT9-E

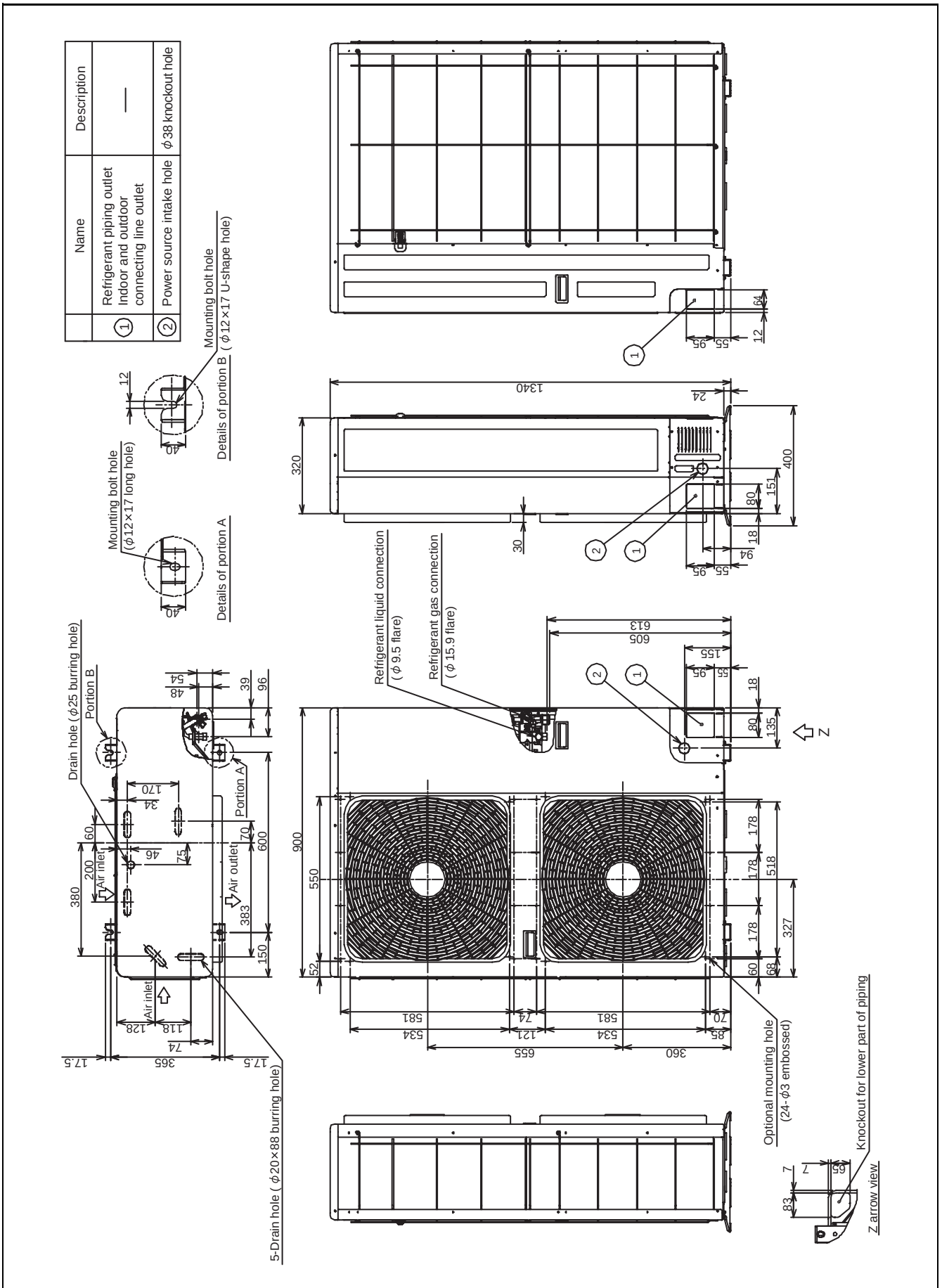


4-2. Outdoor unit

HWS-802H-E

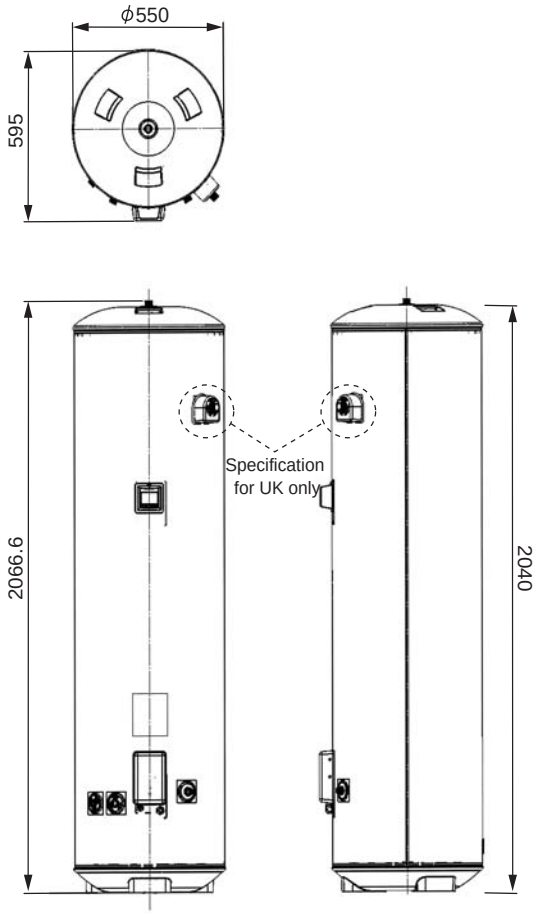

Name
Description
① Refrigerant piping outlet Indoor and outdoor connecting line outlet
—
② Power source intake hole
ϕ 38 knockout hole
Mounting bolt hole (ϕ 12×17 U-shape hole)
Details of portion B
Mounting bolt hole (ϕ 12×17 long hole)
Details of portion A
Refrigerant liquid connection (ϕ 9.5 flare)
Refrigerant gas connection (ϕ 15.9 flare)
Drain hole (ϕ 25 burring hole)
Portion B
Portion A
Air inlet
Air outlet
5-Drain hole (ϕ 20 × 88 burring hole)
Optional mounting hole (12-ϕ 3 embossed)
Knockout for lower part of piping
Z arrow view

HWS-1102H-E, 1402H-E

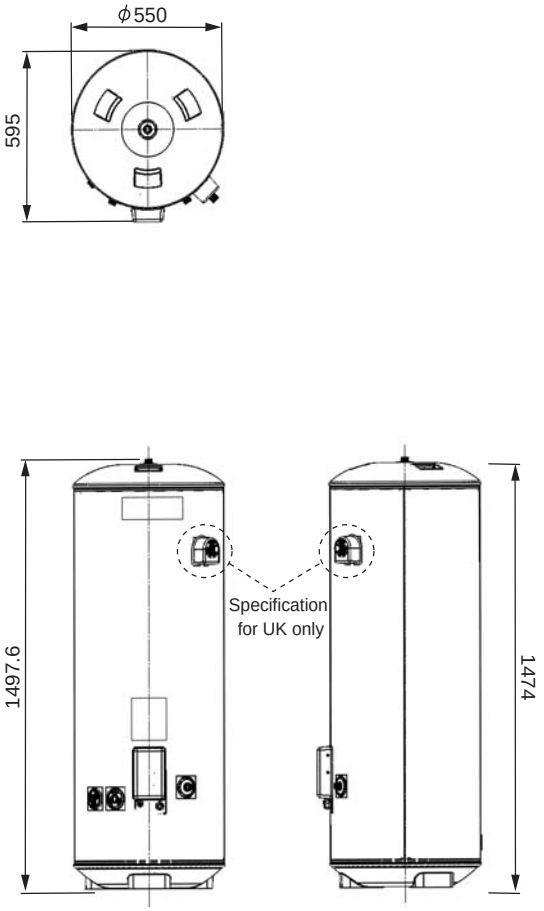

Name
Description
① Refrigerant piping outlet Indoor and outdoor connecting line outlet
—
② Power source intake hole
ϕ38 knockout hole
Mounting bolt hole (ϕ12×17 long hole)
Details of portion A
Mounting bolt hole (ϕ12×17 U-shape hole)
Details of portion B
Refrigerant liquid connection (ϕ9.5 flare)
Refrigerant gas connection (ϕ15.9 flare)
Drain hole (ϕ25 burring hole)
Portion B
Portion A
Air inlet
Air outlet
5-Drain hole (ϕ20×88 burring hole)
Optional mounting hole (24- ϕ3 embossed)
Knockout for lower part of piping
Z arrow view
Z

4-3. Hot water cylinder

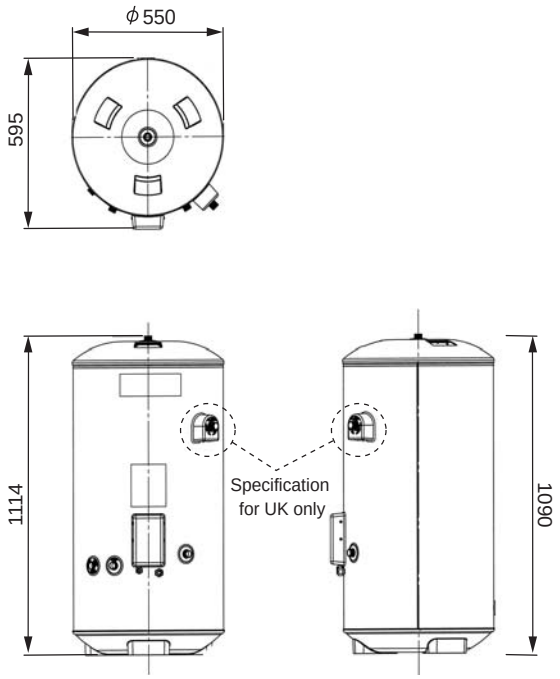
HWS-3001CSHM3-E(-UK)



HWS-2101CSHM3-E(-UK)

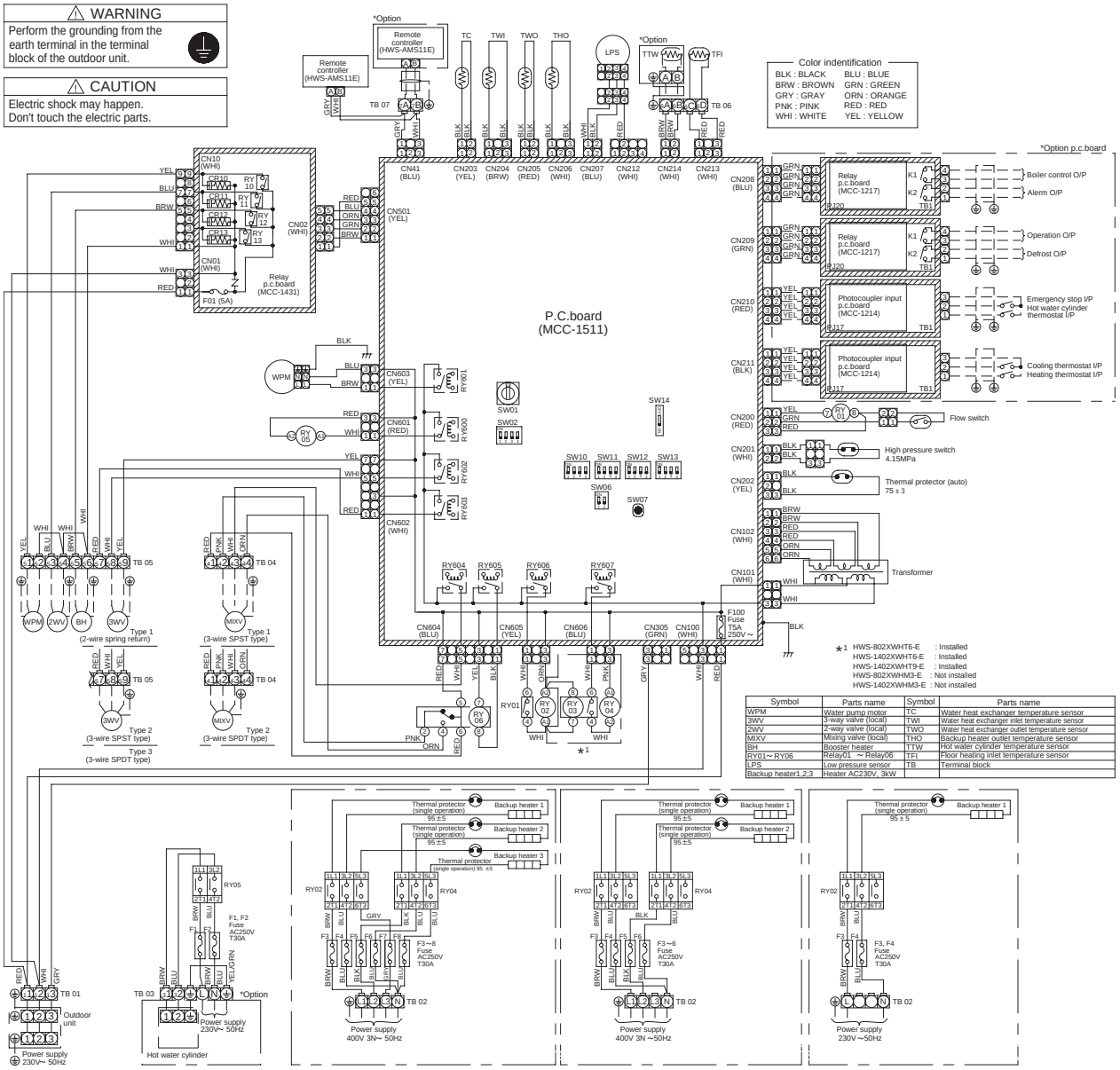


HWS-1501CSHM3-E(-UK)



5 Wiring Diagram

5-1. Hydro Unit



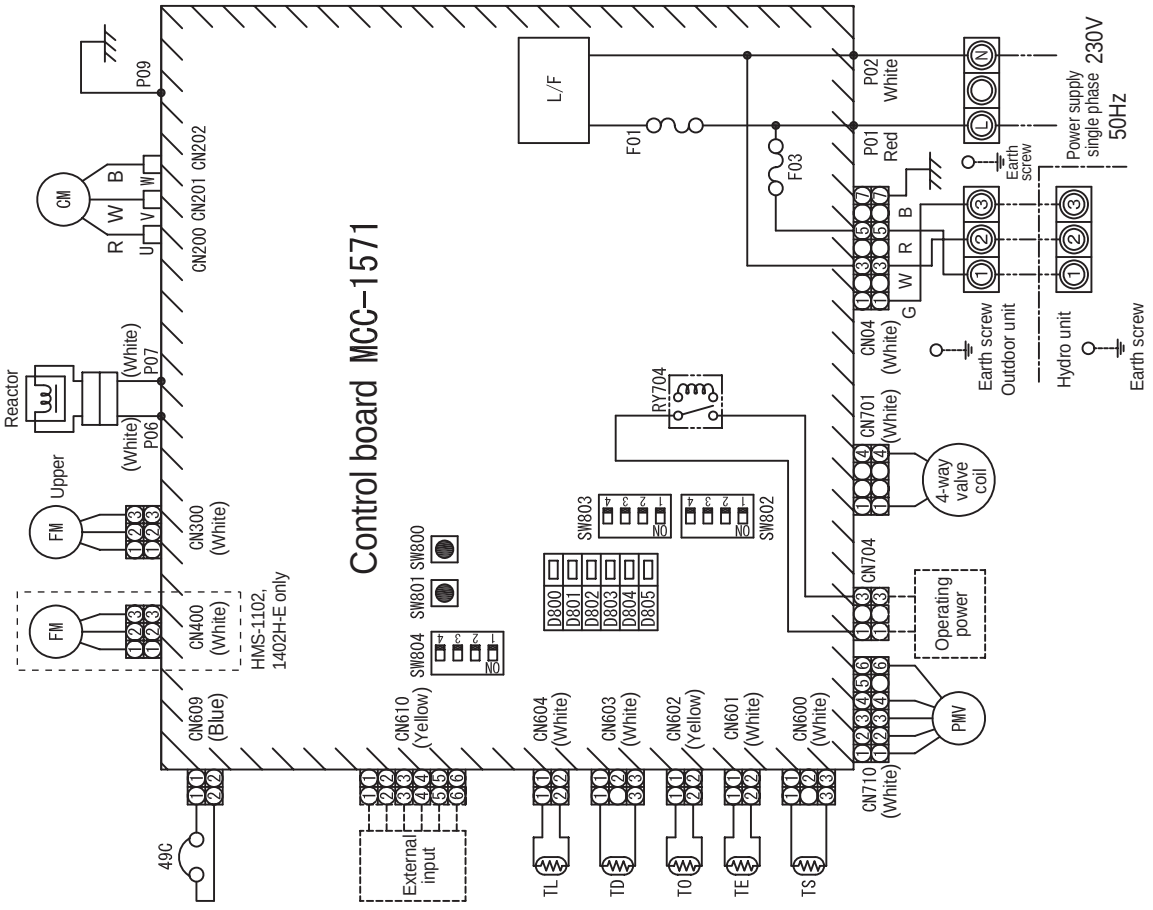
Symbol	Parts name	Symbol	Parts name
WPM	Water pump motor	TC	Water heat exchanger temperature sensor
3WV	3-way valve (local)	TWI	Water heat exchanger inlet temperature sensor
2WV	2-way valve (local)	TWO	Water heat exchanger outlet temperature sensor
MIXV	Mixing valve (local)	THO	Backup heater outlet temperature sensor
BH	Booster heater	TTW	Hot water cylinder temperature sensor
RY01～RY06	Relay01 ～Relay06	TFI	Floor heating inlet temperature sensor
LPS	Low pressure sensor	TB	Terminal block
Backup heater1,2,3	Heater AC230V, 3kW		

1. The one-dot chain line indicates wiring at the local site, and the dashed line indicates accessories sold separately and service wires, respectively.
2. ○, and □ indicates the terminal board and the numberals indicate the terminal numbers.
3. ▨ indicates P.C. board.
   * Be sure to fix the electric parts cover surely with screws. (Otherwise water enters into the box resulting in malfunction.)

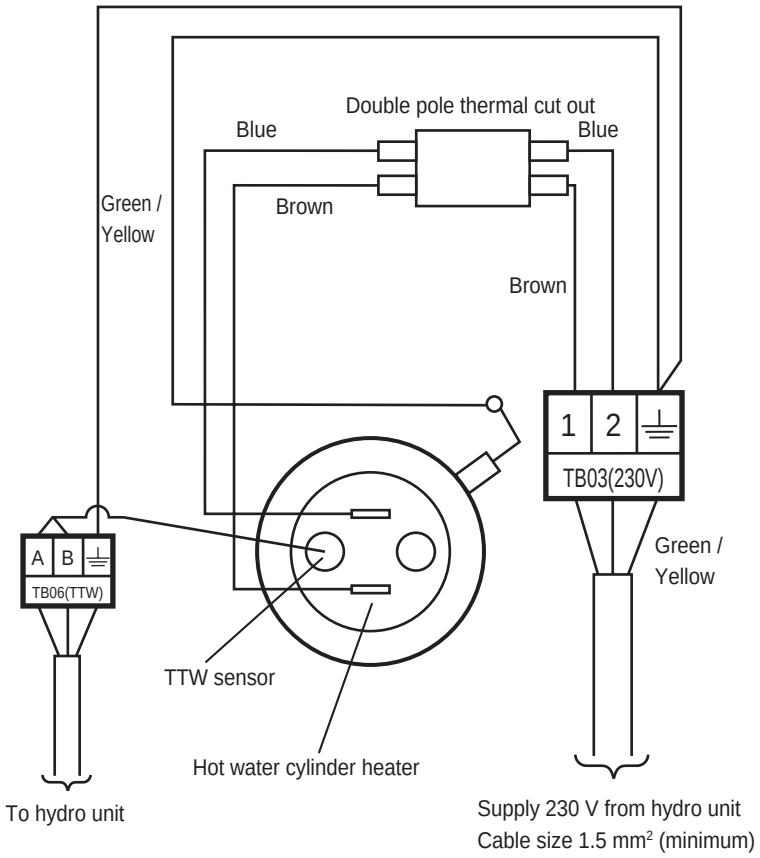
5-2. Outdoor Unit

Symbol	Item nam
CM	Compressor
FM	Fan motor
PMV	Pulse motor valve coil
TD	Discharge temperature sonsor
TS	Suction temperature sensor
TE	Heat exchange sensor 1
TL	Heat exchange sensor 2
T0	Outdoor temperature sensor
49C	Compressor case thermostat
F01	Fuse 25 A, 250 VAC
F03	Fuse 10A, 250 VAC

1. ◎ indicates a terminal plate. The number inside indicates the terminal number.
2. The double-dashed line indicates a local wiring while the dashed line indicates an optional accessory or service wiring.
3. ▨ indicates a printed board.
4. For the hydro unit circuit, see the hydro unit wiring diagram.



5-3. Hot Water Cylinder Unit



6 Key Electric Component Rating

6-1. Hydro Unit

HWS-802XWHM3-E, 802XWHT6-E

No.	Component name	Model name		Type name	Rating
		M3-E	T6-E		
1	Circulating pump	O	O	UPS025-65 K 130	AC230 V 0.54 A (MAX)
2	Backup heater 6 kW	O	O	–	AC 400 V (3N) 6 kW (AC230 V 3 kW compatible)
3	Backup heater 9 kW			–	AC400V (3N) 9 kW
4	Water heat exchange temperature sensor (TC sensor)	O	O	–	10 kΩ (25°C)
5	Water inlet temperature sensor (TWI sensor)	O	O	–	10 kΩ (25°C)
6	Water outlet temperature sensor (TWO sensor)	O	O	–	10 kΩ (25°C)
7	Heater outlet water temperature sensor (THO sensor)	O	O	–	10 kΩ (25°C)
8	Floor inlet temperature sensor (TFI sensor)	O	O	–	10 kΩ (25°C)
9	Pressure switch	O	O	–	Operating pressure 4.15 MPa +0 -0.3 MPa
10	Low pressure sensor	O	O	–	Operating pressure 0.20 MPa
11	Bimetal thermostat (auto)	O	O	–	Operating temperature 75±3°C DC42 V / 0.2 A
12	Bimetal thermostat (single operation)	O	O	–	Operating temperature 95±5°C AC250 V / 16 A
13	Flow switch	O	O	–	Operating flowing quantity 13 L/min
14	Output board (OP)	OP	OP	TCB-PCIN3E	AC230 V 0.5 A DC24 V 1 A
15	Input board (OP)	OP	OP	TCB-PCM03E	Contact input
16	Remote control	O	O	HWS-AMS11E	
17	Water 3-way valve terminal	O	O	–	AC230 V 0.1 A 2Wire, 3Wire SPST, SPDT type mountable
18	Water 2-way valve terminal	O	O	–	AC230 V 0.1 A 2Wire type mountable
19	Mixing valve terminal	O	O	–	AC230 V 0.1 A 3Wire SPST, SPDT type mountable
20	Circulating pump terminal	O	O	–	AC230 V 1.0 A
21	Booster heater terminal	O	O	–	AC230 V 1.0 A
22	Fuse	O	O	–	AC 250 V 30 A

O ····· Applied
OP····· Optional accessory

HWS-1402XWHM3-E, 1402XWHT6-E, 1402XWHT9-E

No.	Component name	Model name			Type name	Rating
		M3-E	T6-E	T9-E		
1	Circulating pump	O	O	O	UPS25-80 130	AC230 V 0.83 A (MAX)
2	Backup heater 6 kW	O	O		–	AC 400 V (3N) 6 kW (AC230 V 3kW compatible)
3	Backup heater 9 kW			O	–	AC 400 V (3N) 9 kW
4	Water heat exchange temperature sensor (TC sensor)	O	O	O	–	10 kΩ (25°C)
5	Water inlet temperature sensor (TWI sensor)	O	O	O	–	10 kΩ (25°C)
6	Water outlet temperature sensor (TWO sensor)	O	O	O	–	10 kΩ (25°C)
7	Heater outlet water temperature sensor (THO sensor)	O	O	O	–	10 kΩ (25°C)
8	Floor inlet temperature sensor (TFI sensor)	O	O	O	–	10 kΩ (25°C)
9	Pressure switch	O	O	O	–	Operating pressure 4.15 MPa +0 -0.3 MPa
10	Low pressure sensor	O	O	O	–	Operating pressure 0.20 MPa
11	Thermal protector (auto)	O	O	O	–	Operating temperature 75±3°C DC42 V / 0.2 A
12	Thermal protector (single operation)	O	O	O	–	Operating temperature 95±5°C AC250 V 16 A
13	Flow switch	O	O	O	–	Operating flowing quantity 18 L/min
14	Output board (OP)	OP	OP	OP	TCB-PCIN3E	AC230 V 0.5 A DC24 V 1 A
15	Input board (OP)	OP	OP	OP	TCB-PCM03E	Contact input
16	Remote control	O	O	O	HWS-AMS11E	
17	Water 3-way valve terminal	O	O	O	–	AC230 V 0.1 A 2Wire, 3Wire SPST, SPDT type mountable
18	Water 2-way valve terminal	O	O	O	–	AC230 V 0.1 A 2Wire type mountable
19	Mixing valve terminal	O	O	O	–	AC230 V 0.1 A 3Wire SPST, SPDT type mountable
20	Circulating pump terminal	O	O	O	–	AC230 V 1.0 A
21	Booster heater terminal	O	O	O	–	AC230 V 1.0 A
22	Fuse	O	O	O	–	AC 250 V 30 A

O ····· Applied
OP····· Optional accessory

6-2. Outdoor Unit

HWS-802H-E

No.	Component name	Type name	Rating
1	Compressor	DA220A2F-22L	
2	Outdoor fan motor	ICF-280-A60-1	Output 60 W
3	4-way valve coil	VHV-01AP552B1	AC230 full-wave rectifier input, alive time 10 sec or less
4	Pulse motor valve (PMV) coil	CAM-MD12TF-15	DC12 V
5	Compressor case thermostat	US-622KXTMQO-SS	OFF: 125±4°C ON: 90±5°C
6	Reactor	CH-56	5.8 mH, 18.5 A
7	PC board	MCC-1571	Input 1Ø, AC230 V±23 V, 50/60 Hz

HWS-1102H-E, 1402H-E

No.	Component name	Type name	Rating
1	Compressor	DA422A3F-25M	
2	Outdoor fan motor (x2)	ICF-280-A100-1	Output 100 W
3	Reactor (x2)	CH-44	1.4 mH, 25 A
4	4-way valve coil	UKV-A038	AC230 V full-wave rectifier input, alive time 10 sec or less
5	Pulse motor valve (PMV) coil	VHV-01AP552B1	DC12 V
6	Board	MCC-1560	Input 3Ø, AC230 V±23 V, 50/60 Hz
7	Compressor case thermostat	US-622KXTMQO-SS	OFF = 125 ± 4 °C, ON = 90 ± 5 °C

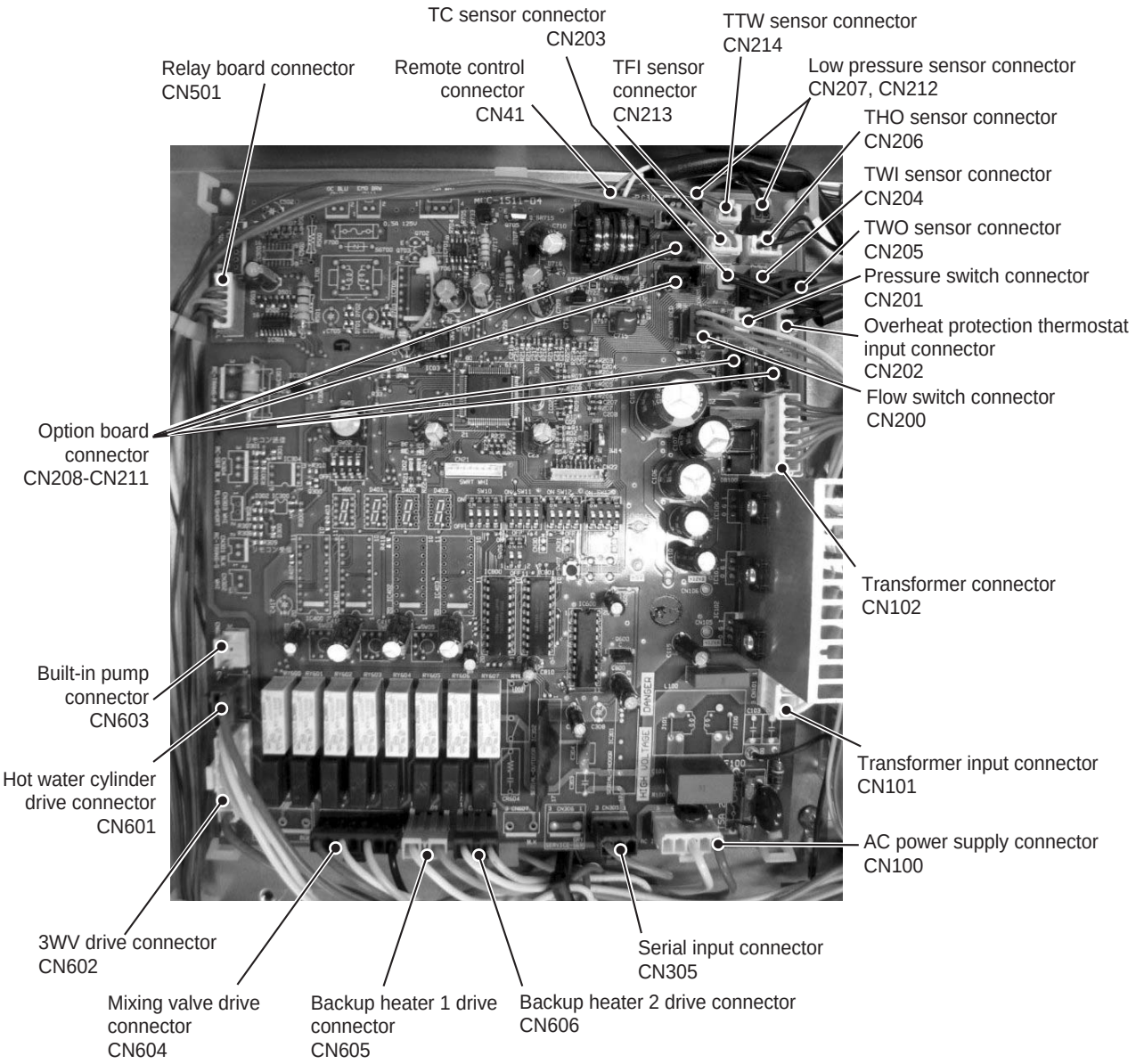
6-3. Hot Water Cylinder Unit

No.	Component name	Model name			Type name	Rating
		1501 CSH M3-E (-UK)	2101 CSH M3-E (-UK)	3001 CSH M3-E (-UK)		
1	Hot water cylinder heater	O	O	O	–	AC230 V 2.75 KW
2	Hot water cylinder temperature sensor (TTW sensor)	O	O	O	–	10 kΩ (25°C)
3	Thermal cut-out	O	O	O	–	Operating temperature Manual reset 82°C (+3k/-2k)

O ····· Applied

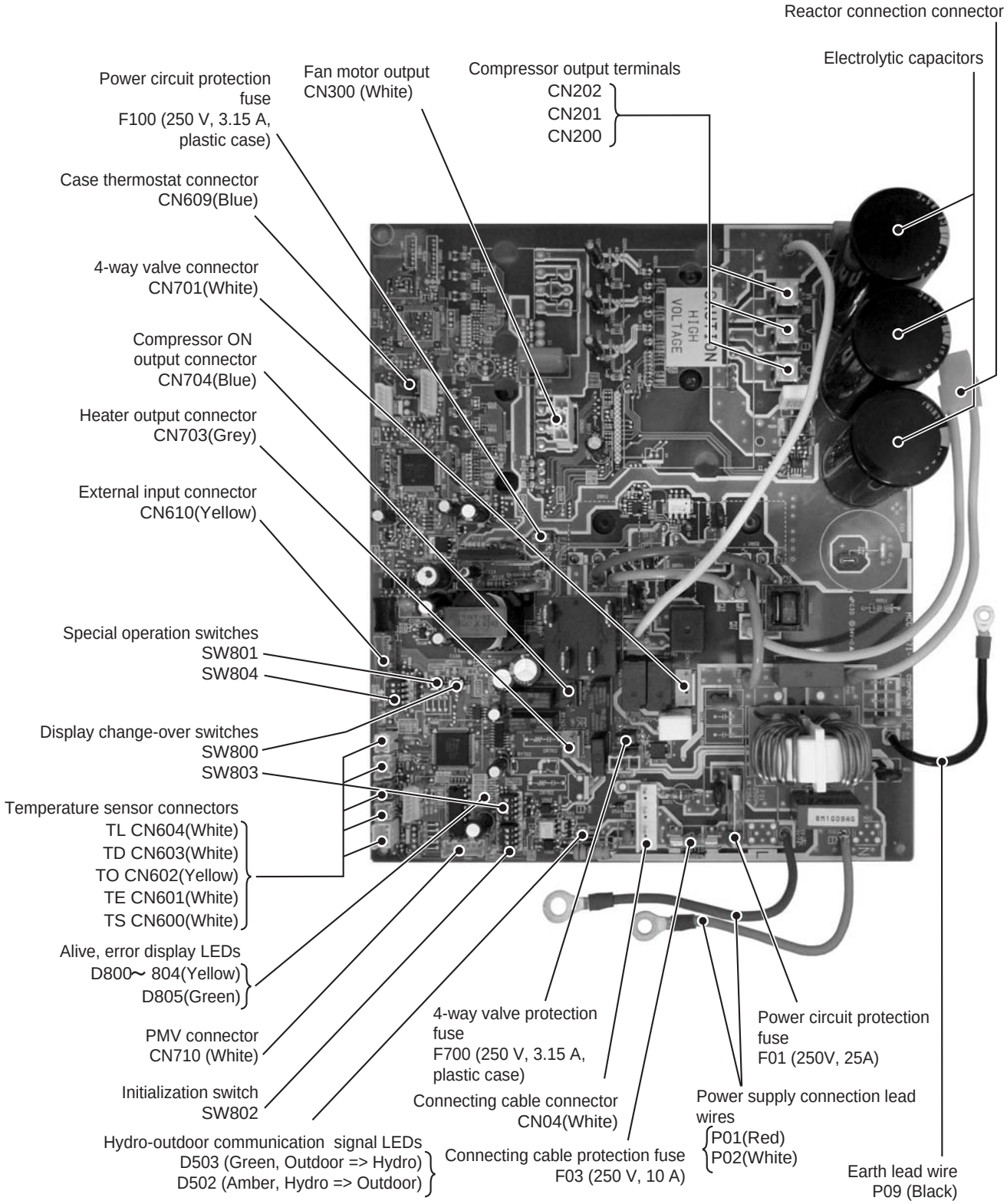
6-4. Water Heat Exchange Control Board

HWS-802XWHM3-E, 802XWHT6-E
HWS-1402XWHM3-E, 1402XWHT6-E, 1402XWHT9-E

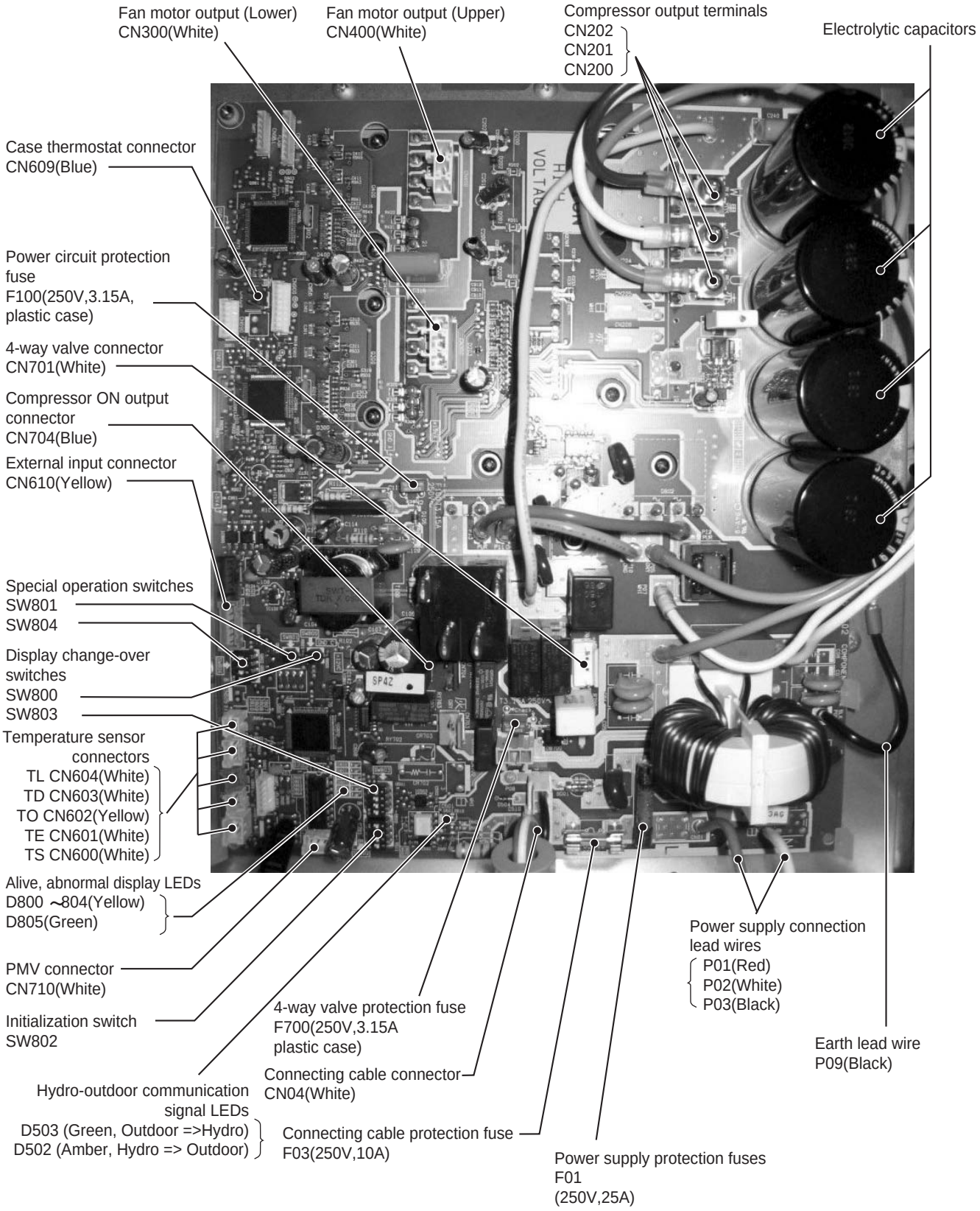

TC sensor connector CN203
TTW sensor connector CN214
Relay board connector CN501
Remote control connector CN41
TFI sensor connector CN213
Low pressure sensor connector CN207, CN212
THO sensor connector CN206
TWI sensor connector CN204
TWO sensor connector CN205
Pressure switch connector CN201
Overheat protection thermostat input connector CN202
Flow switch connector CN200
Option board connector CN208-CN211
Transformer connector CN102
Built-in pump connector CN603
Transformer input connector CN101
Hot water cylinder drive connector CN601
AC power supply connector CN100
3WV drive connector CN602
Serial input connector CN305
Mixing valve drive connector CN604
Backup heater 1 drive connector CN605
Backup heater 2 drive connector CN606

6-5. Outdoor Control Board

HWS-802H-E

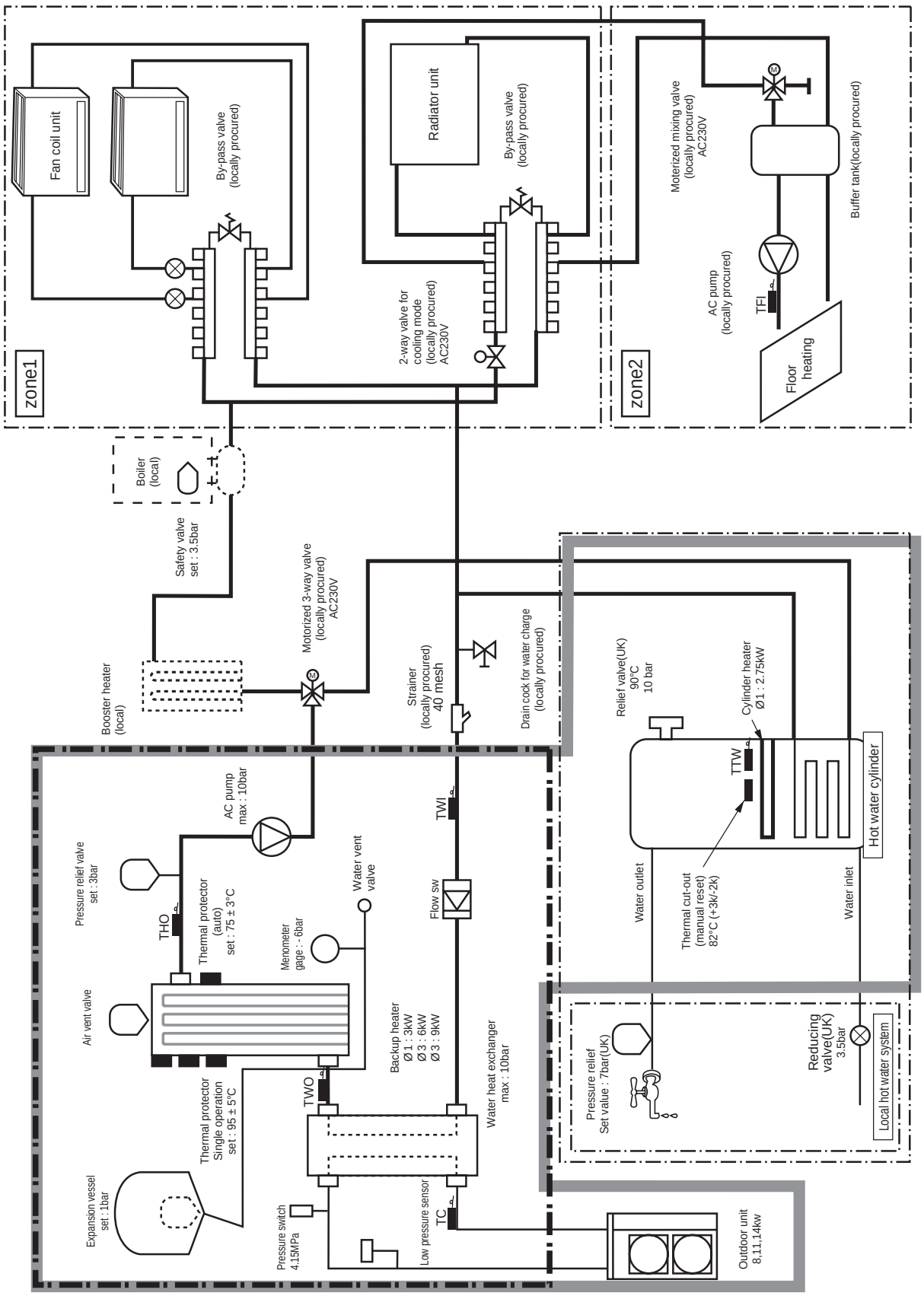


HWS-1102H-E, 1402H-E

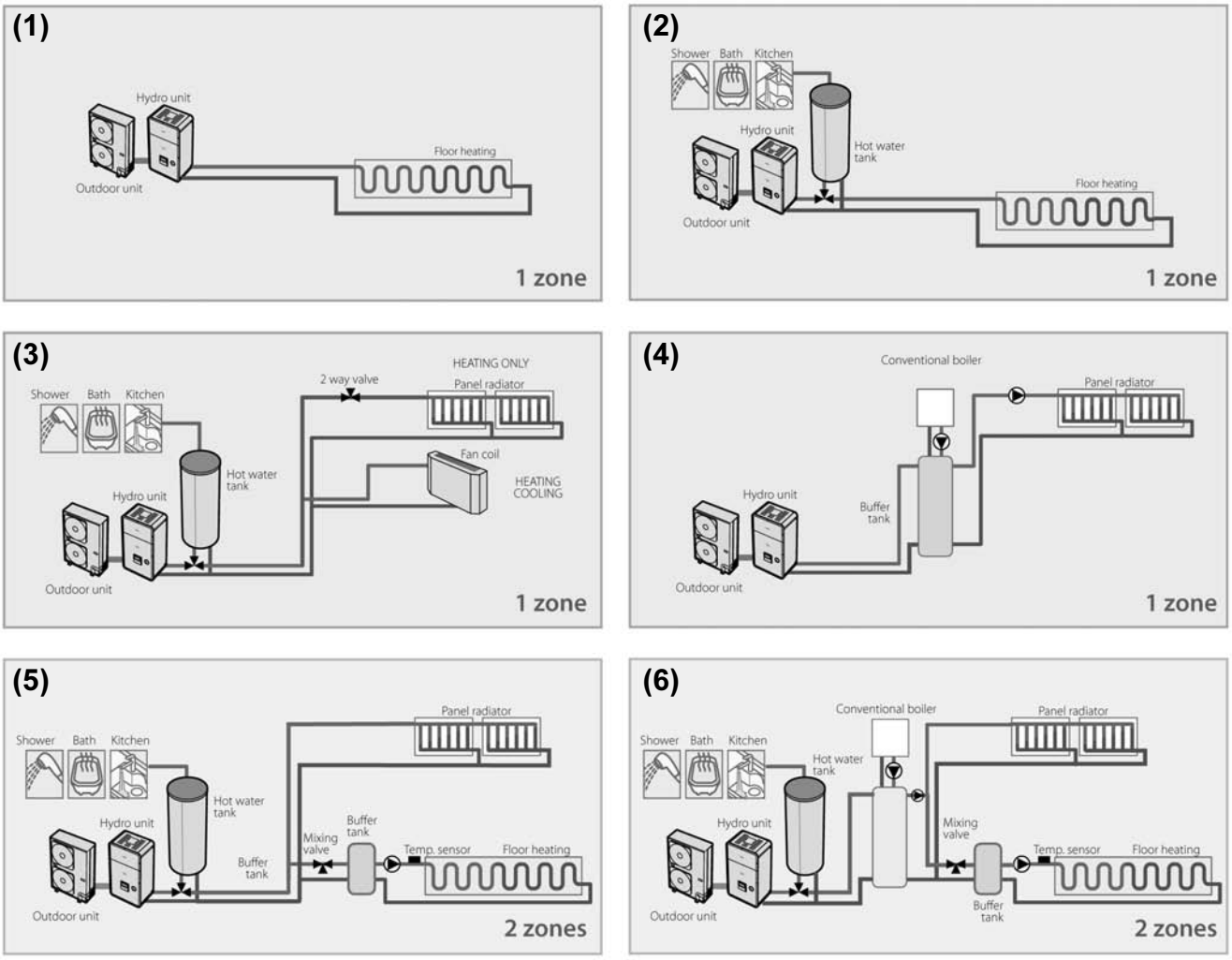


7 Refrigeration Cycle / Water System Diagram

7-1. Water System Diagram



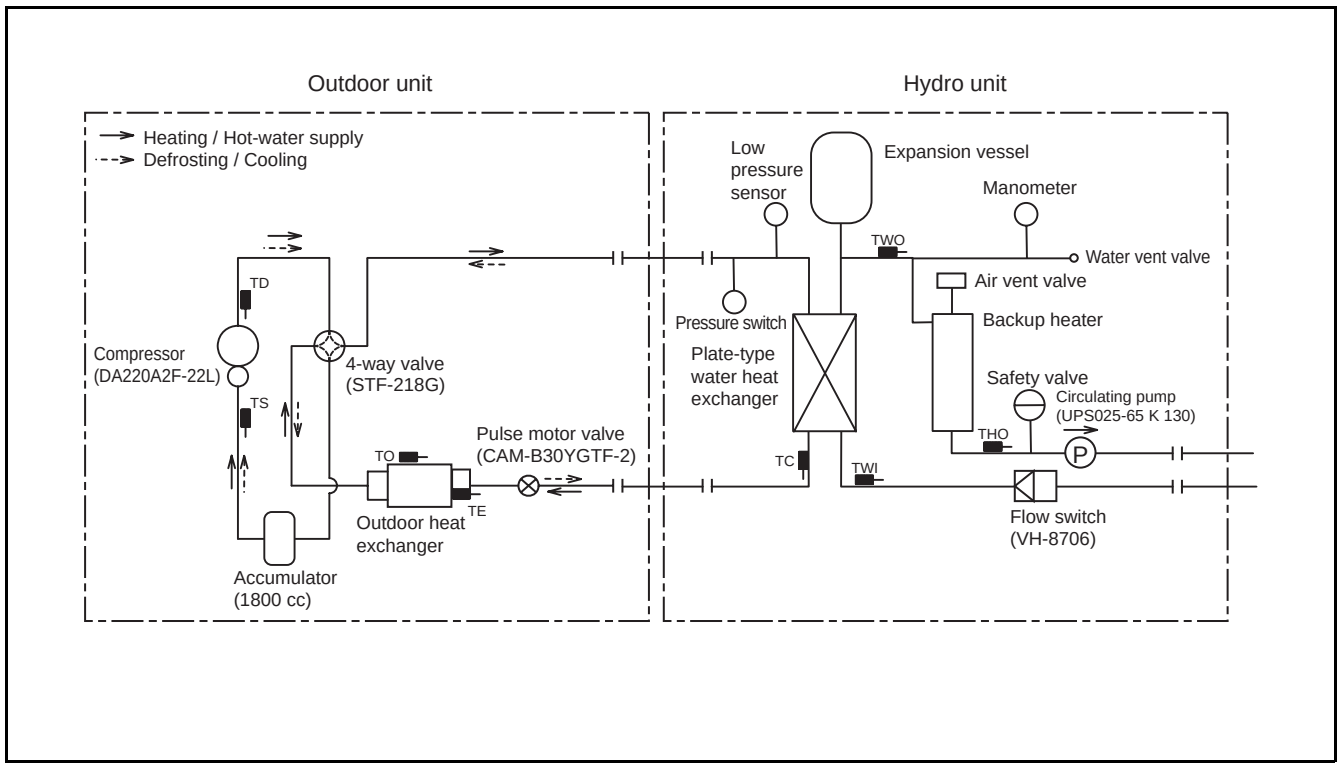
Installation example of water circuit



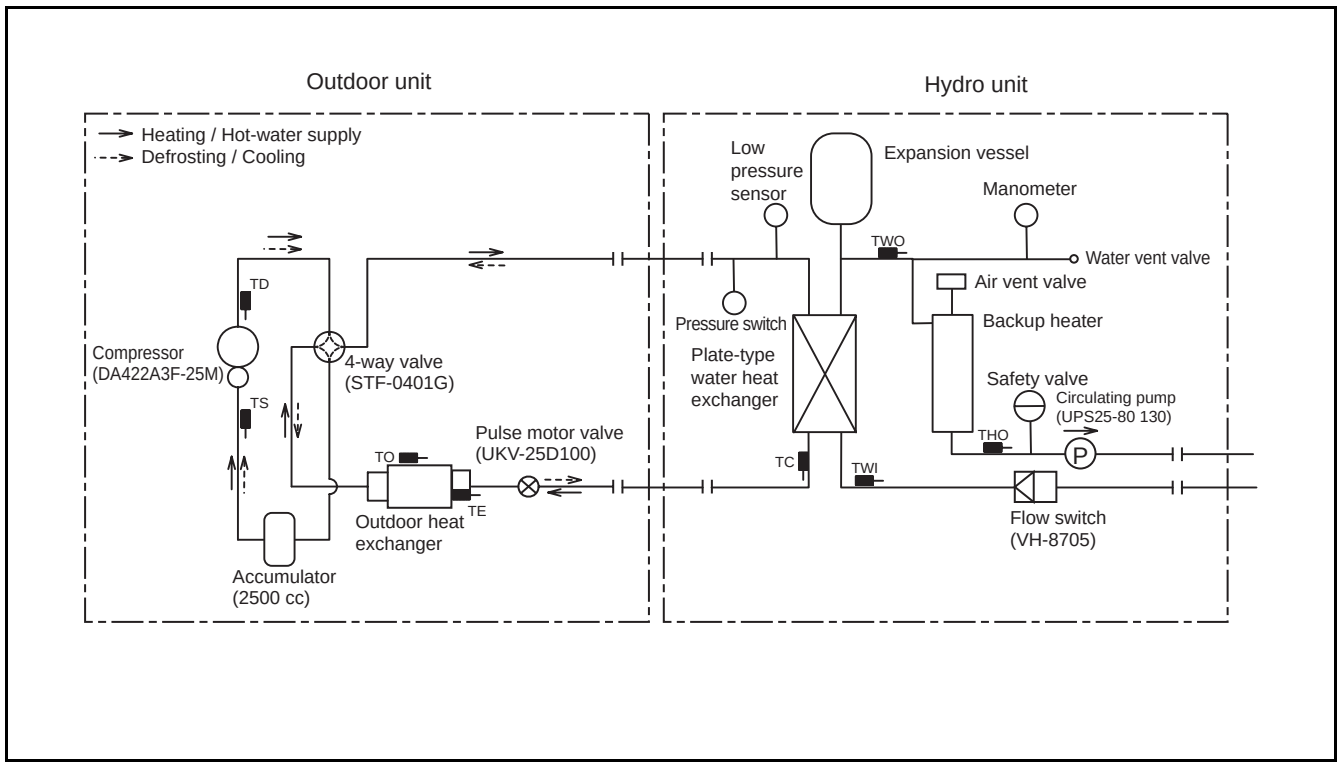
The water circuit for a system without buffer tank ((1), (2), (3), (5)) requires 5 or more branches of Floor heating or Radiator etc.
Less than 5 branches may cause a flow deficiency. In this case, please provide a buffer tank and secondary pumps as shown in (4).

7-2. Refrigeration Cycle System Diagram

HWS-802XWHM3-E, 802XWHT6-E/802H-E



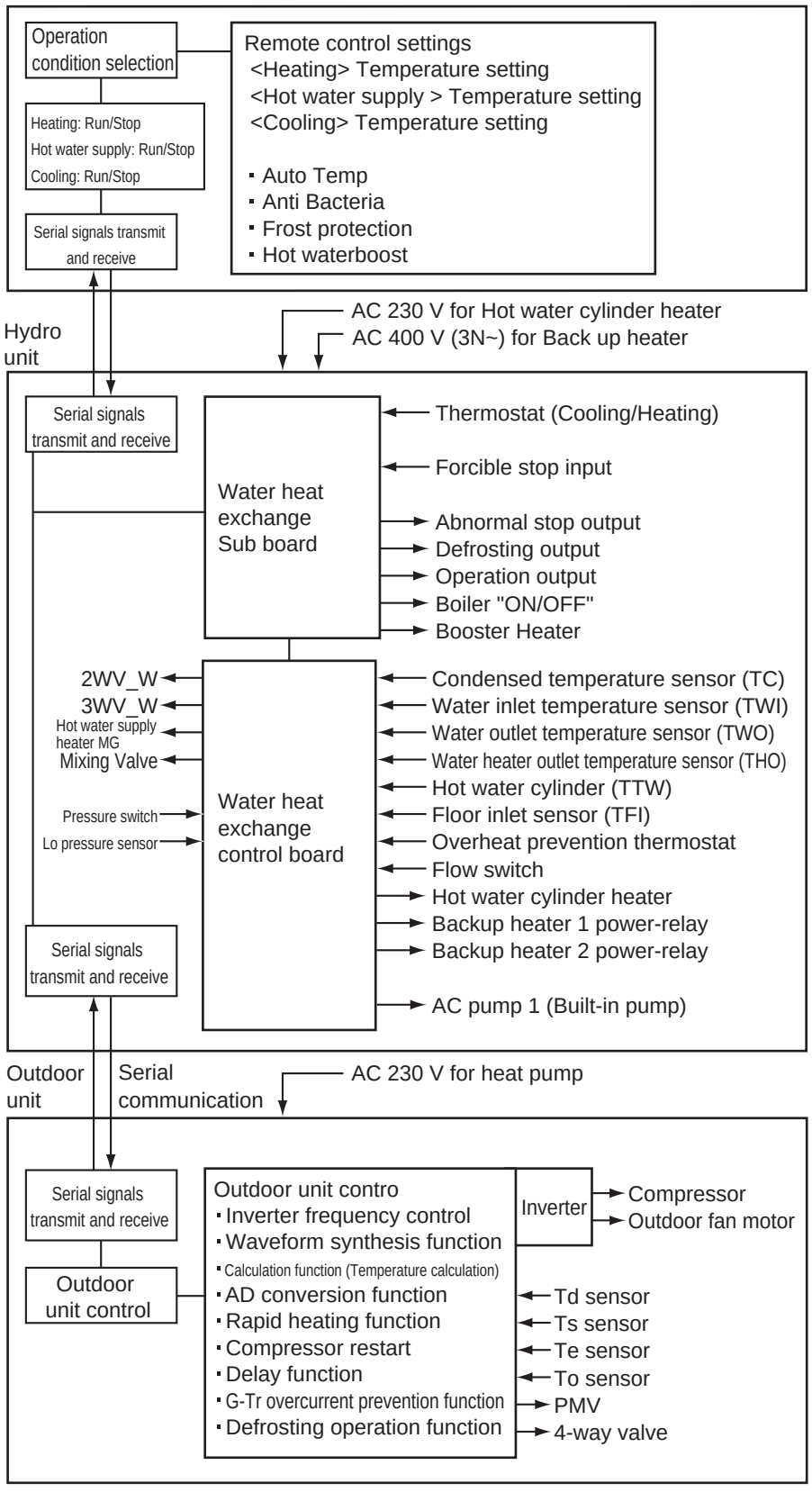
HWS-1402XWHM3-E, 1402XWHT6-E, 1402XWHT9-E/1102H-E, 1402H-E

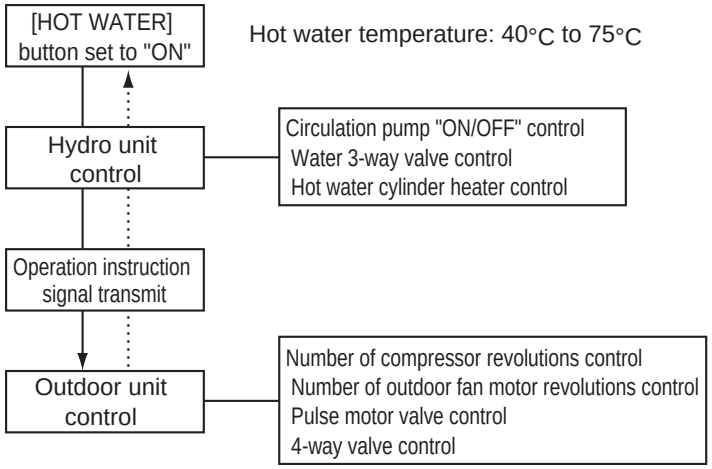
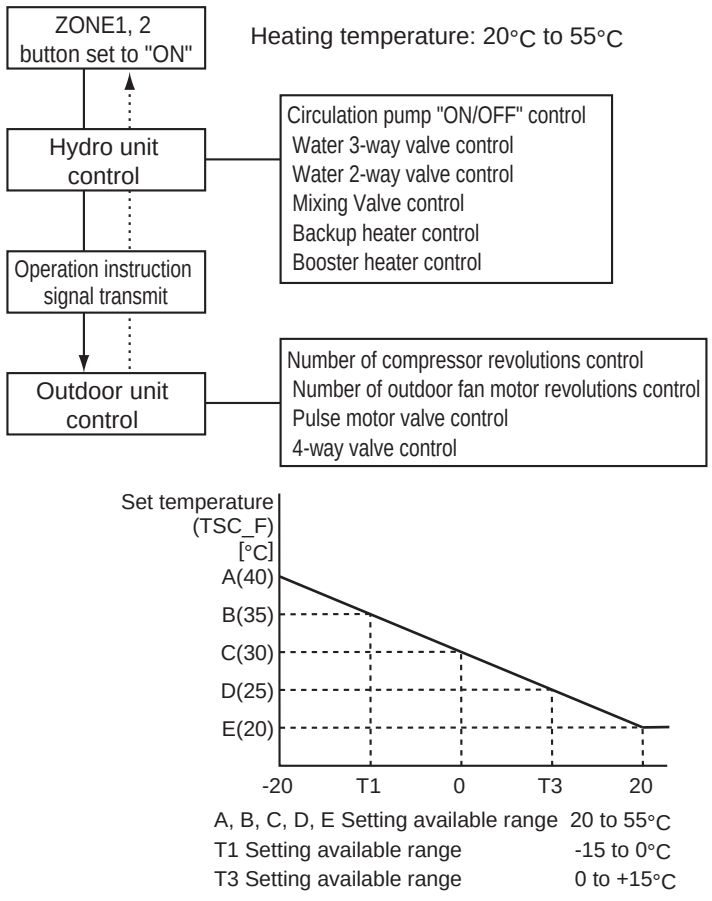


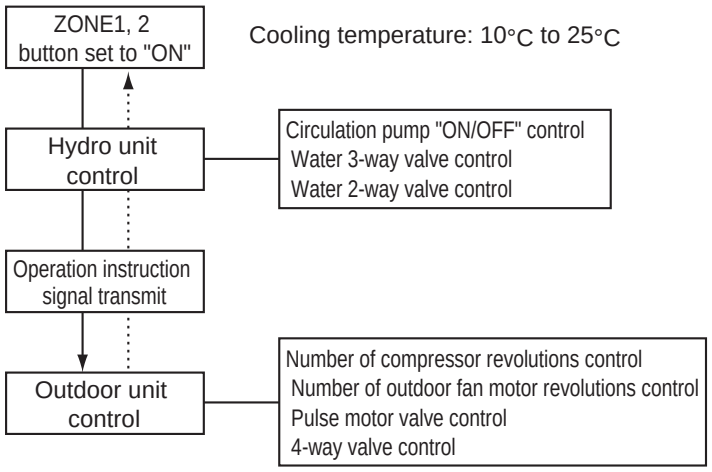
8 Operational Description

This chapter describes the working circuit and control of Air to Water Heat Pump about the following operations.

	Item	Page
8-1	**Basic Operation** 1) Operation control 2) Hot water supply operation 3) Heating operation 4) Cooling operation	36-38
8-2	**Operation Mode and Control Method** 1) Hot water supply operation 2) Heating operation 3) Cooling operation 4) Simultaneous operation of “hot water supply" and "heating” 5) Simultaneous operation of “how water supply" and "cooling” 6) Boiler-assisted heating operation 7) HOT WATER BOOST operation 8) Anti bacteria 9) Night setback operation 10) FROST PROTECTION operation 11) AUTO operation 12) Nighttime low-noise operation	39-47
8-3	**Hydro Unit Control** 1) Capacity control (compressor, high-temperature release, low-temperature release) 2) Heater control 3) Circulation pump control 4) Flow switch control 5) Mixing valve control (2-temperature heating control) 6) Q-H characteristics of hydro unit 7) Automatic restart control 8) Piping anti-freezing control	48-56
8-4	**Outdoor Unit Control** 1) PMV (Electronic control valve) control 2) Outlet temperature release control 3) Current release control 4) Current releases shift control 5) Outdoor fan control 6) Defrosting control 7) Winding heating control 8) Continued operation prevention under short-circuit conditions 9) Overcurrent protection control	57-63

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	1) Operation control Remote controller 	1. Purpose The operations of the hydro unit and the outdoor unit are controlled according to user-defined operation condition settings. 2. Details The operation controls include those shown in the left. 3. Operations 1) An operation condition is selected with the remote controller. 2) Setting the remote controller button to “ON” transmits a signal to the hydro unit. 3) The hydro unit controller controls the operations shown in the left while also controlling the water 2-way valve, water 3-way valve, circulation pump, mixing valve, hot water cylinder heater, and backup heater. 4) The hydro unit controller transmits an operation instruction to the outdoor unit, and uses serial signals to transmit and receive control statuses. 5) The outdoor unit control unit performs the operation controls shown in the left while also controlling the compressor, outdoor fan motor, pulse motor valve, and 4-way valve.

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	2) Hot water supply operation 	Hot water supply operation 1. Purpose Hot water supply 2. Details This section performs hot water supply operation according to heating conditions specified for the steps in the left. 3. Operations 1) Set the [HOT WATER] remote controller button to “ON”. 2) The hydro unit controller starts to transmit a hot water supply operation signal to the outdoor unit control unit. 3) The hydro unit performs the operation controls shown in the left while also controlling the circulation pump, hot water cylinder heater “ON/OFF”. 4) The outdoor unit controls the compressor, outdoor fan motor, electric expansion valve, and 4-way valve based on the operation signals transmitted by the hydro unit.
	3) Heating operation 	Heating operation 1. Purpose Heating 2. Details This section performs heating operation according to heating conditions specified for the steps in the left. 3. Operations 1) Set the [ZONE1, 2] remote controller button to “ON”. 2) The hydro unit controller starts to transmit a heating operation signal to the outdoor control unit. 3) The hydro unit performs the operation controls shown in the left while also controlling the circulation pump, backup booster heater “ON/OFF”, water 2-way valve, and water 3-way valve. 4) The outdoor unit controls the compressor, outdoor fan motor, electric expansion valve, and 4-way valve based on the operation signals transmitted by the hydro unit.

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	4) Cooling operation  **NOTE:** **No coding mode in default setting. When use the cooling mode, please change the FC02 to "0".** Related FC FC No. / Setting item / Default / Setting available range 02 / Cooling mode availability / 1: No / 0: Yes	1. Purpose Cooling 2. Details This section performs cooling operation according to cooling conditions specified for the steps in the left. 3. Operations 1) Set the [ZONE1, 2] remote controller button to "ON". 2) The hydro unit controller starts to transmit a cooling operation signal to the outdoor unit control unit. 3) The hydro unit controller performs the operation controls shown in the left while also controlling the circulation pump, water 2-way valve, and water 3-way valve. 4) The outdoor unit controls the compressor, outdoor fan motor, pulse motor valve, and 4-way valve based on the operation signals transmitted by the hydro unit.

Item	Operation flow and applicable data, etc.

8-2. Operation Mode and Control Method

The following shows the operation modes and controlled objects.

Operation mode / Controlled object	Cooling only	Heating only	Hot water supply only	Heating and Hot water				Cooling and Hot water			
				Heat pump select for heating		Heat pump select for hot water supply		Heat pump select for cooling		Heat pump select for hot water supply	
				Heating side	Hot water supply side	Heating side	Hot water supply side	Cooling side	Hot water supply side	Cooling side	Hot water supply side
Heat pump	O	O	O	O	×	×	O	O	×	×	O
Backup heater	×	O	×	O	×	×	×	×	×	×	×
Hot water cylinder heater	×	×	O	×	O	×	O	×	O	×	O

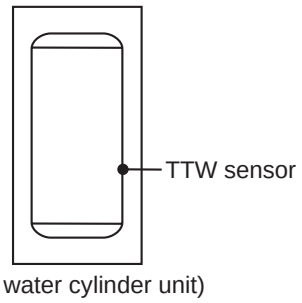
O Possible
× Not possible

1) Hot water supply operation

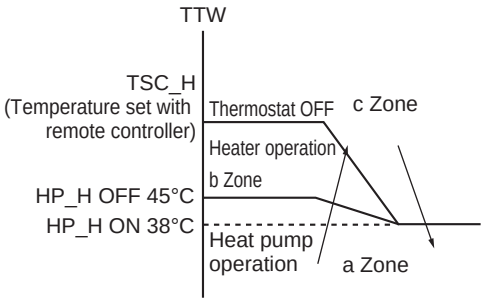
1) Operation start condition
When the [HOT WATER] remote controller button is pressed and the following operation start condition is met, the operation starts.
- TTW < 38°C is detected.

2) Operation mode determination
An operation mode is determined according to the temperature of TTW sensor.
- Heat pump operation selection *1 *2
- When TTW < 38°C (a zone in the right figure) is met, the heat pump operation is selected.
- Heater operation selection
  When 45°C ≦ TTW < TSC_H (b zone in the right figure) is met, the heater operation is selected.
- Thermostat status "OFF" selection
  When TTW ≧ TSC_H is met, the thermostat status "OFF" is selected.

3) Operation stop
The operation stops in the following cases.
- The remote controller gives a stop instruction.
- TTW ≧ TSC_H is met.



(Hot water cylinder unit)



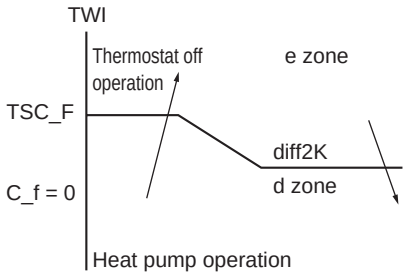
TSC_H is hot water temperature set with remote controller

*1: When the outside temperature is -20°C or below, the heater operation is selected even if the TTW temperature falls into "a zone".
*2: When "Hot water supply" and "Heating" are simultaneously in operation, the heater operation may be selected depending on the outside air temperature.

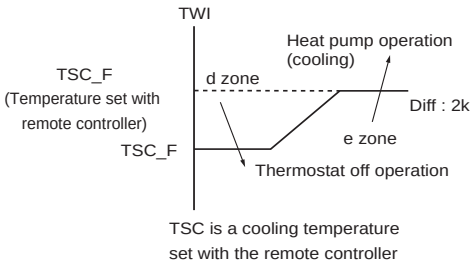
Related FC

FC No.	Setting item	Default	Setting available range
1E	Upper limit of hot water supply temperature	75°C	60-80°C
1F	Lower limit of hot water supply temperature	40°C	40-60°C
20	Heat pump start temperature	38°C	20-45°C
21	Heat pump end temperature	45°C	40-50°C
24	Outside air correction start temperature for hot water supply*3	0°C	-20-10°C
25	Outside air correction temperature for hot water supply*3	3 deg	0 -15 deg

*3:When the outside temperature is 0°C or below, the boil-up temperature will be higher that setting temperature in hot water supply mode.

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	2) Heating operation <Operation only for ZONE1> • This operation is enabled when DP_SW12_2 ZONE1 is set to "ON" (default). • The remote controller displays [ZONE 1] settings, and only the set temperature of [ZONE 1] can be changed. <Operation for ZONE1 and ZONE2 (2 temperatures control)> • This operation is enabled when DP_SW12_2 ZONE1 is set to "ON" (default) and DP_SW12_3 ZONE2 to "ON". • The remote controller displays [ZONE 1] [ZONE 2] settings, and the set temperatures of [ZONE 1] [ZONE 2] can be changed. • To set temperatures for [ZONE 1] and [ZONE 2], use SELECT (◁ ▷) to switch [ZONE 1] and [ZONE 2]. • For 2 temperatures control, the flow adjustment of MIXING VALVE controls the water temperature of [ZONE 2]. For details, see the description on MIXING VALVE control in 8-3-5. 1) Operation start condition Pressing the [ZONE1, 2] button of remote controller starts a heating operation. *1 *2 2) Operation mode selection An operation mode is determined according to the temperature of TWI sensor. • Heat pump operation selection *1 *2 When TWI < TSC_F (d zone in the right figure) is met, the heat pump operation is selected. • Thermostat status "OFF" When TWI ≧ TSC_F (e zone in the right figure) is met, the thermostat status "OFF" is selected. 3) Operation stop condition When the following condition is met, the heating operation stops. • The remote controller gives a stop instruction. *1: When the outside temperature is -20°C or below, the heater operation is selected even if the TTW temperature falls into "d zone". *2: When "Hot water supply" and "Heating" are simultaneously in operation, the heater operation may be selected depending on the outside air temperature.  TSC_F is a heating temperature set with remote controller Related FC **FC No. / Setting item / Default / Setting available range** 1A / Upper limit of heating (Zone1) limited temperature / 55 / 37-55°C 1B / Lower limit of heating (Zone1) limited temperature / 20 / 20-37°C 1C / Upper limit of heating (Zone2) limited temperature / 55 / 37-55°C 1D / Lower limit of heating (Zone2) limited temperature / 20 / 20-37°C

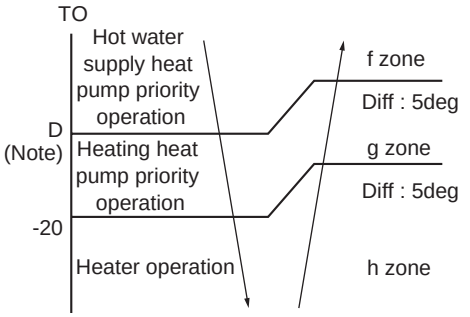
Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	3) Cooling operation Pressing the [ZONE1, 2] button and then [OPERATION MODE] starts a cooling operation. 1) Operation start condition Pressing the [ZONE1, 2] button and then [OPERATION MODE] starts a cooling operation. 2) Operation mode selection An operation mode is determined according to the temperature of TWI sensor. • Heat pump operation selection *1 *2 When TWI ≧ TSC_F (d zone in the right figure) is met, the heat pump operation is selected. • Thermostat status "OFF" When TWI < TSC_F (e zone in the right figure) is met, the thermostat status "OFF" is selected. 3) Operation stop condition When either of the following conditions is met, the cooling operation stops. • The remote controller gives a stop instruction. • The operation is switched to heating. *1: When the outside temperature is 10°C or below, cooling does not start even if the TWI temperature falls into "d zone". Related FC



FC No.	Setting item	Default	Setting available range
02	Cooling mode availability	1: No	0: Yes
18	Upper limit of cooling setting temperature	25	18-30°C
19	Lower limit of cooling setting temperature	10	10-18°C

4) Simultaneous operations of "hot water supply" and "heating"
At the time of "Hot water supply" and "Heating" simultaneous operation, the operation mode is select as follows depending on the outside air temperature.

- f zone Operation with hot water supply priority
A heat pump operation is performed in the hot water supply side, and a heating operation in the heating side.
- g zone Operation with heating priority
A heat pump operation is performed in the heating side, and a heating operation in the hot water supply side.



Operation mode by zone

Zone	Hot water supply side	Heating side
f	Heat pump *	Stop *
g	Heater	Heat pump
h	Heater	Heater

* Note that after a heat pump operation for "Hot water supply" is selected in f zone, when the operation moves to a heater operation for "hot water" and then 5 minutes has passed (Hot water supply operation in b zone), the operation mode changes as follows.

Zone	Hot water supply side	Heating side
f'	Heater	Heat pump

When TTW ≧ 45°C (FC: changeable) is met, the operation ends f' zone and returns to f zone.

Related FC

FC No.	Setting item	Default	Setting available range
07	Maximum HP operation time in “hot water supply” + “heating mode”	30 min	0-120min
22	Priority mode switch temperature (D)	0	-20-20°C

* Note: When user selects “hot water supply” and “ZONE1,2”, and Heat pump selects hot water supply mode, the Maximum operating time of heat pump is 30 mins.

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	5) Simultaneous operations of "hot water supply" and "cooling" For simultaneous operations of "hot water supply" and "cooling", basically cooling runs by a heat pump operation, and hot water supply by a heater operation.

	Hot water supply side	Cooling side
Normal	Heater *	Heat pump *

* Note that after a "cooling" heat pump operation is selected, if the thermostat off status continues for 10 minutes and TTW < 38°C is met, the operation switches to a hot water supply operation.

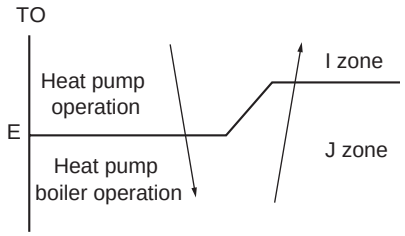
	Hot water supply side	Cooling side
Cooling thermostat off 10 min. passed	Heat pump	Stop

When TTW ≧ 45°C (FC: changeable) is met, the operation returns to the normal mode.

6) Boiler-assisted heating operation

This operation is enabled when DPSW13_2 is ON (A boiler exists).

- I zone Heat pump operation
  A heat pump operation is usually performed.
- J zone Heat pump operation + Boiler operation *1
  A heat pump + boiler operations (*2) are performed, and a heater operation is performed in the Hot water supply side.

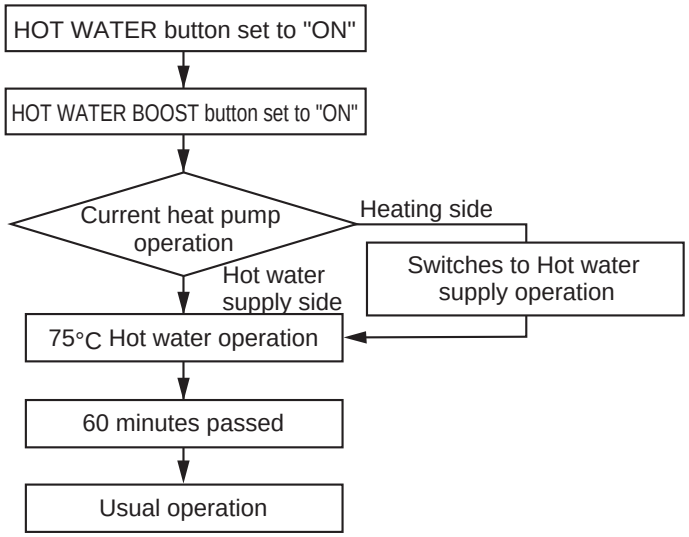


*1: In J zone, the hydro unit setting has a priority, and when the set temperature is reached, the boiler output also becomes OFF.
Setting FC_3E to "1" makes the boiler has a priority, and even if the hydro unit set temperature is reached, the boiler output remains "ON".

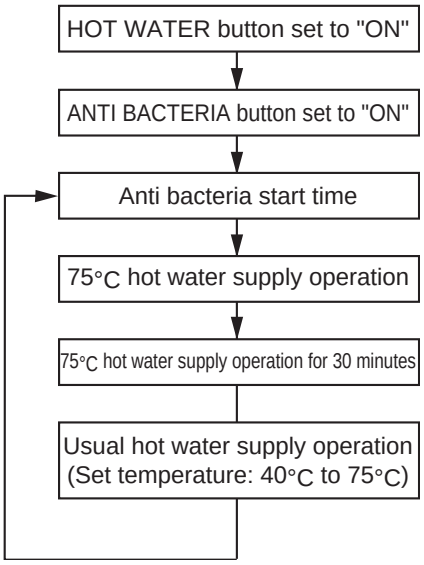
*2: The boiler operation only gives boiler instruction from the hydro unit through the option board.

Related FC

FC No.	Setting item	Default	Setting available range
23	Heat pump only / Simultaneous operation switching TO temperature (E)	-10	-20-20°C
3E	Hydro unit setting / Boiler set temperature priority switching	0: Priority on hydro unit setting	1: Priority on boiler setting

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	7) Hot water boost operation A hot water boost operation boils water quickly to the set temperature TSC_H = 75°C (FC_09). 1) How to operate • When pressing the [HOT WATER BOOST] button after pressing the remote controller [HOT WATER] button, a heat pump operation in progress in the heating side switches to in the hot water side, and continues the operation regardless of the hot water supply start condition, TTW < 38°C. In addition, the hot water cylinder is immediately energized to start a Hot water supply operation under TSC_H = 75°C. • A hot water boost operation returns to the usual operation after 60 minutes. • The remote controller display during a hot water boost operation is the same as the set temperature display of a usual Hot water supply operation. • The usual set temperature change is used for changing the set temperature during a hot water boost operation. Change the BOOST set temperature with FC_09, if necessary.  Related FC

FC No.	Setting item	Default	Setting available range
09	HOT WATER BOOST set temperature	75°C	40-80°C
08	HOT WATER BOOST operation time	60 mins	30-180 mins Every 10 mins

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	8) Anti bacteria (ANTI BACTERIA) operation An anti bacteria operation regularly performs a Hot water supply operation with the set temperature TSC_H = 75°C (can be set with FC_0A). 1) How to operate • Pressing the [HOT WATER] button and then the remote controller [ANTI BACTERIA] button changes the setting to TSC_H = 75°C at the set cycle and time (both can be set with the remote controller FC) to start ANTI BACTERIA operation. • The first auti bacteria operation starts when press the [ANTI BACTERIA] button and starting time come. • When the set temperature 75°C is reached after the ANTI BACTERIA operation started, the set temperature remains another 30 minutes (can be set with FC_0B). • The priority zone determined by the outside temperature selects an operation, Hot water heat pump or hot water supply heater. • The hot water heat pump operation, when selected, ignores the hot water supply start condition (TTW < 38°C) and forcibly performs a hot water operation. • During ANTI BACTERIA operation (Forcible hot water operation at 75°C), the hot water set temperature display is not changed. If it is changed from the remote controller, the normal hot water set temperature will be changed.  **⚠ Caution** • During a 75°C hot water supply operation with ANTI BACTERIA, the remote controller does not display 75°C. • Be careful not to burn yourself; Output water may be hotter than that displayed on the remote controller. Related FC **FC No.** / **Setting item** / **Default** / **Setting available range** 0A / Anti bacteria set temperature / 75°C / 70-80°C 0B / Anti bacteria holding time / 30 mins / 0 - 60 mins Remote control OC / Anti bacteria start time / 22:00 / 0:00-22:00 Remote control OD / Anti bacteria operation cycle / 7 days / Every day to 10 days

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	9) Night set back (NIGHT SET BACK) operation A night set back operation performs heating at 5°K lower and cooling at 5°K temperatures against the remote controller set temperature from the setting start time (22:00) to the end time (6:00) every day. **Note)** • Set the remote controller time before starting a NIGHT SET BACK operation. • The set time can be changed with remote controller FC. Related FC

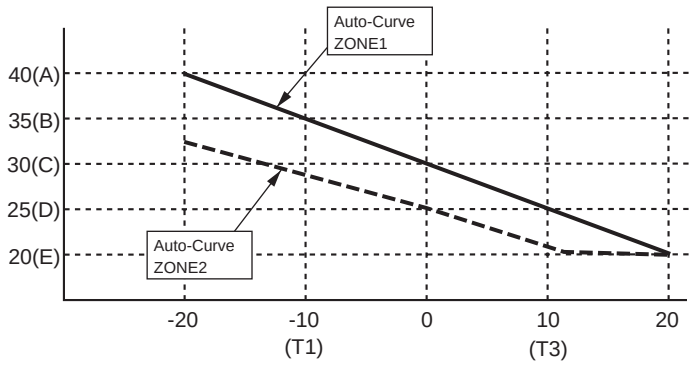
FC No.	Setting item	Default	Setting available range
Remote controller OE	Night set back start Time setting	22:00	0:00-23:00
Remote controller OF	Night set back end Time setting	6:00	0:00-23:00
26	Night set back setting Temperature width	5 deg	3 -20 deg

10) FROST PROTECTION operation
A frost protection operation performs heating at the set temperature RSC_F = 15°C (FC).

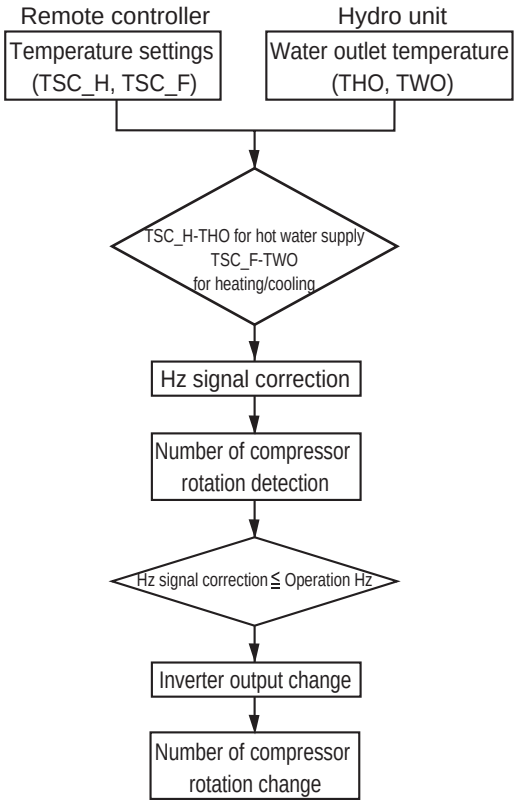
1) How to operate
- Pressing the remote controller [ZONE1, 2] button and then the [FROST PROTECTION] button starts a heating operation at the set temperature of 15°C.
- Pressing again the [FROST PROTECTION] button cancels the FROST PROTECTION operation.
- The remote controller displays "F" as the temperature during FROST PROTECTION.
- A set temperature change during a FROST PROTECTION operation cancels the operation.

Related FC

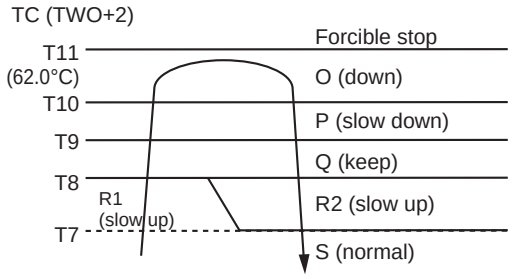
FC No.	Setting item	Default	Setting available range
3A	FROST PROTECTION Yes / No	1: Yes	0: No
3B	FROST PROTECTION Set temperature	15°C	10-20°C

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	11) AUTO operation An auto operation sets the water temperature TSC_F depending on the outside temperature TO by following the table below. 1) How to operate • Pressing the remote controller [ZONE1, 2] button and then the [AUTO] button starts AUTO operation for heating. An operation starts at the set temperature of straight -line approximation for the following: water temperature 40°C with the outside temperature -20°C (FC), 35°C with -10 °C (T1)(FC), 30°C with 0°C (FC), 25°C with 10°C (T3), and 20°C with 20°C (TC). • For 2-temperature control, although Auto-Curve in ZONE2 shows 80% of that of ZONE1 (FC), the water temperature setting does not fall below 20°C. • During an AUTO operation, pressing again the [AUTO] button returns to the usual manual set heating operation. • The remote controller displays "A" as the temperature during an AUTO operation. (When 2-temperature control is enabled, the remote controller displays "A" "A".) • Long-pressing the [AUTO] button during an AUTO operation activates the Auto-Curve FC change mode, enabling the set Auto-Curve water temperature to be changed in the ±5K range. (FC_27) • Even if the temperature setting is changed during an AUTO operation, the operation continues. • An AUTO operation works with a heating operation only, not with a cooling or a hot water supply operation.  Related FC **FC No. / Setting item / Default / Setting available range** 27 — Set temperature shift with heating set to Auto — 0 — -5 to 5 k 29 — Outside air temperature T1 temperature — -10°C — -15-0°C 2B — Outside air temperature T3 temperature — 10°C — 0-15°C 2C — Set temperature when out side air temperature is -20 °C. — 40°C — 20-55°C 2D — Set temperature when out side air temperature is -10 °C (T1). — 35°C — 20-55°C 2E — Set temperature when out side air temperature is 0 °C. — 30°C — 20-55°C 2F — Set temperature when out side air temperature is 10 °C (T3). — 25°C — 20-55°C 30 — Set temperature when out side air temperature is 20 °C. — 20°C — 20-55°C 31 — Auto-Curve ratio of ZONE2 — 80% — 0-100%

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	12) Nighttime low-noise operation A night time low-noise operation reduces operation frequency and the number of outdoor fan rotations for a certain period during nighttime as noise control for neighborhood. Maximum operation frequency 40.2 Hz (Hot water supply/ Heating/ Cooling) Maximum fan tap 460 rpm (802H-E) 500 rpm (1102H-E, 1402H-E) The nighttime low-noise operation is enabled/ disabled by changing the remote controller FC_09. **<How to set>** 1) Press the TEMP. (▼) and TEST (↶) button at the same time for 4 seconds or longer. (Shifted to the nighttime low-noise setting mode) The Code No. field displays "09", and the DATA "0000", SETTING, and ✣ being displayed blink. 2) Press TIME (▼) (▲) to set enable "1" or disable "0". Pressing SET ( ) change DATA and SETTING display to be lit and the setting is confirmed. (When "1" as enable is set, the nighttime low-noise setting is enabled, the control starts at the set start time.) 3) Press TEST (↶) to exit the nighttime low-noise time setting mode. The SETTING and ✣ goes out, returning to its original status.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	1) Capacity control (compressor, high-temperature release, low-temperature release) This unit controls the compressor frequency and heater output so that the water outlet temperature matches the remote controller set temperature. 1-1) Compressor control • Calculates the different between the remote controller set temperature (TSC_H, TSC_F) and the water outlet temperature (Hot water supply: THO, Heating: TWO). • Sets the Hz signal correction amount that determines the number of compressor rotations by the temperature difference. • Detects the number of compressor rotations. • Compares the Hz signal correction amount and the current operation Hz, and changes the compressor output according to the difference. * The control details are the same for hot water supply, heating, and cooling.  Compressor frequency changeable range 10 Hz to 70 Hz (802, 1402H-E) 10 Hz to 60 Hz (1102H-E)

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	1-2) High temperature release control A heat pump operation is performed as shown in the table below according to the TC sensor detecting temperature. • For the detected temperature, TC (= TWO + 2 degree) of a heat pump operation is used. The values of T7 through T10 vary depending on TWI. (See the table below) • If the compressor frequency instruction from the hydro unit is less then 10 Hz, the compressor stops. • TC > 62°C causes the compressor to stop abnormally. When the compressor restarts 140 seconds after the stop and TC > 62°C is not detected for 20 minutes, the abnormal stop counter is cleared. 10 times of compressor abnormal stop stops the operation of heat pump, and confirms the abnormality (Display: A11). * If the heat pump operation is switched to other operation, the abnormality detection counter is reset to 0.



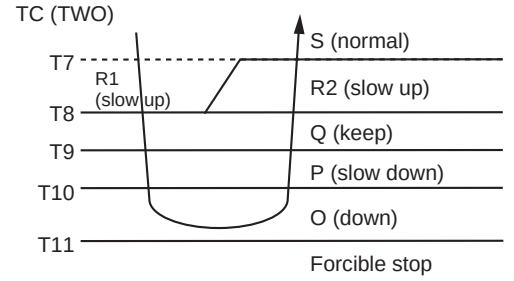
Zone	Control operation
R1	Increase compressor frequency by 1.2 Hz every 60 secs.
R2	Increase compressor frequency by 0.6 Hz every 60 secs.
O	Decrease compressor frequency to 70% every 10 secs.
P	Decrease compressor frequency by 3 Hz every 10 secs.
Q	Keep compressor frequency.

TC=TWO+2deg (°C)

TWI	T7	T8	T9	T10	T11
TWI<30	57.0	59.0	60.0	61.0	62.0
30 ≦ TWI<35	57.0	59.0	60.0	61.0	62.0
35 ≦ TWI<40	56.5	58.5	59.5	60.5	62.0
40 ≦ TWI<45	56.5	58.5	59.5	60.5	62.0
45 ≦ TWI<50	56.0	58.0	59.0	60.0	62.0
50 ≦ TWI	56.0	58.0	59.0	60.0	62.0

1-3) Low temperature release control
A heat pump operation is performed as shown in the table below according to the TC sensor detecting temperature.
- For the detected temperature, TC = TWO of a heat pump operation is used. The values of T7 through T10 varies depending on TWI. (See the table below)
- If the compressor frequency instruction from the hydro unit is less then 10 Hz, the compressor stops.
- TC < 3°C causes the compressor to stop abnormally. When the compressor restarts when 140 seconds has passed after the stop and TC < 3°C is not detected for 20 minutes, the abnormal stop counter is cleared. 10 times of compressor abnormal stop stops the operation of heat pump, and confirms the abnormality (Display: A11).

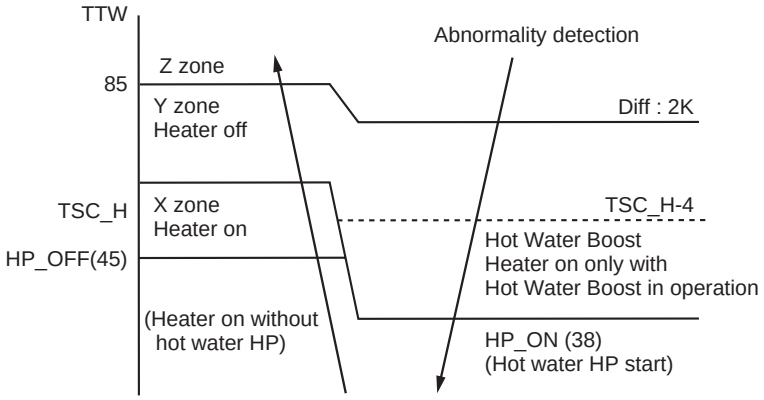
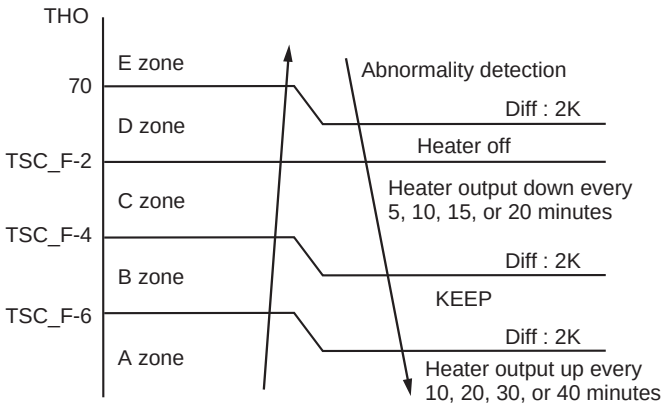
* If the heat pump operation is switched to other operation, the abnormality detection counter is reset to 0.



Zone	Control operation
R1	Increase compressor frequency by 1.2 Hz every 60 secs.
R2	Increase compressor frequency by 0.6 Hz every 60 secs.
O	Decrease compressor frequency to 70% every 10 secs.
P	Decrease compressor frequency by 3 Hz every 10 secs.
Q	Keep compressor frequency.

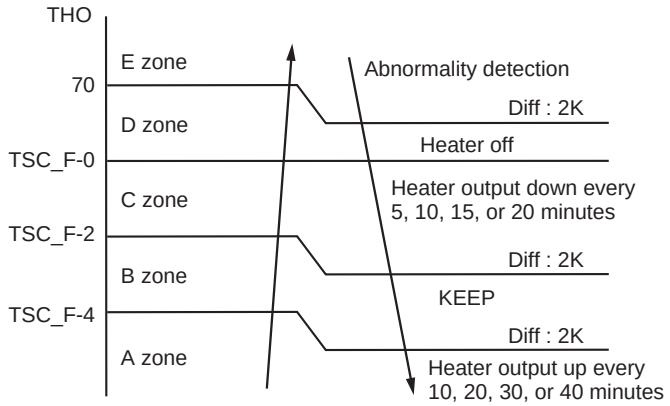
TC=TWO (°C)

TWI	T7	T8	T9	T10	T11
TWI<10	10.0	8.0	6.0	4.0	3.0
10 ≦ TWI<15	10.5	8.5	6.5	4.5	3.0
15 ≦ TWI<20	11.0	9.0	7.0	5.0	3.0
20 ≦ TWI	11.5	9.5	7.5	5.5	3.0

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	2) Heater control 2-1) Hot water supply operation During a hot water heat pump operation, the unit energizes the hot water cylinder heater (2.75 kW) when all the following conditions are met. Note that when the hot water supply set temperature (TSC_F) is reached, the unit stops energizing the heater. • When 30 minutes has passed after the hot water heat pump operation started. • The water inlet temperature (TWI) reaches 50°C. • The hot water cylinder sensor reaches the HP_OFF temperature (45°C-FC). • The HP_ON temperature (38°C-FC) is reached without the hot water HP status. • HOT WATER BOOST operation is in progress. 
	2-2) Heating operation 1) Heater control at the time of heat pump operation • Object to be controlled: Backup heater The backup heater control starts when 13 minutes has passed after the heating heat pump operation started and select the ZONE (A-D). The backup heater control increases, decreases, or maintains the number of heaters every 10 minutes (FC) depending on the difference between the heating set temperature (TSC_F) and the heater outlet temperature (THO). When the heating set temperature (TSC_F) is reached, the hydro stops energizing the backup heater.  The single-phase model of 3 kW has the backup heater 1 only. The three-phase model of 6 kW has heater 1+2 of 6 kW.

Status	Heater ON / OFF
Heater 1	Backup heater 3 kW = ON
Heater 2	Backup heater 9 kW = ON

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	2) Control at the time of heating heater operation • Controlled Object: Backup heater, Booster heater The backup heater control starts when 13 minutes has passed after the heating heat pump operation started. The backup heater control increases, decreases, or maintains the number of heaters every 10 minutes (FC) depending on the difference between the heating set temperature (TSC_F) and the heater outlet temperature (THO). Note that when the heating set temperature (TSC_F) is reached, the unit stops energizing the heater.



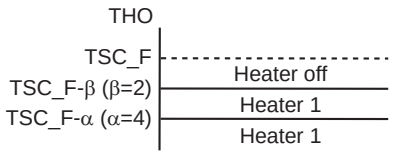
Status	Heater ON / OFF
Heater 1	Backup heater 3 kW = ON
Heater 2	Backup heater 9 kW = ON
Heater 3	Heater 2 + Booster heater

The single-phase model of 3 kW has the backup heater 1 only.
The three-phase model of 6 kW has heater 1+2 of 6 kW.
Contact point output only is available for booster heater.

Related FC

FC No.	Setting item	Default	Setting available range
20	Hot water supply heat pump start temperature	38°C	20-45°C
21	Hot water supply heat pump stop temperature	45°C	40-50°C
33	Heater control of down time	1:10 mins	0:5 mins 2:15 mins 3:20 mins
34	Heater control of up time	0:10 mins	1:20 mins 2:30 mins 3: 40 mins

2-3) Heater control at the time of defrosting
• Object to be controlled: Backup heater
When a defrosting operation starts during the heating heat pump operation, the unit energizes a backup heater (3 kW) according to the heater outlet temperature sensor (THO) and the set temperature (TSC_F) as follows.



1) When the heater outlet temperature sensor (THO) drops to the temperature of 2°C below the set temperature

Defrosting ends according to the usual heater control.

Status	Heater ON / OFF
Heater 1	Backup heater 3 kW = ON

2-4) Forcible heater energization
To prevent freeze, the unit energizes or stops energizing a backup heater (3 kW) regardless of the unit status, not operated or in operation.
• Object to be controlled: Backup heater
1) Energization start condition: TWO < 4 or TWI < 4 or THO < 4
2) Energization stop condition: TWO ≧ 5 and TWI ≧ 5 and THO ≧ 5
Defrosting ends according to the usual heater control.

2-5) No heater operation
According to the DP_SW11 setting, the unit switches the energize/ not energize for the hot water cylinder, backup heater, and booster. For details, see 10-1.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	3) Circulation pump control One circulation pump (enhancing pump P2) can be connected to the unit in addition to the built-in circulation pump P1. DP_SW10-1, 3 within the water heat exchanger enables the built-in pump P1 to be set either to usual energization or only HP and backup heater energization, and also enables the enhancing pump P2 to be set either to interlocked or non-interlocked with the built-in pump.

Item	Heater ON / OFF	Initial value	Switch
AC pump	01: None		
	02: None		
	03: Enhanced pump (P2) Interlock / Non-interlock with built-in pump	OFF: Interlock*2	SW10-3
Existence & position setting	04: None		

*1 The pump 1 in HP operates only in hot water supply side.
*2 Setting the enhancing pump P2 to non-interlock sets the pump P1 to usual energization.

3-1) Circulation pump (Built-in pump P1)
Pump type: AC motor, rated voltage 230V, manually changeable 3-level pump speed

The pump operation starts when the following condition is met.
- The [HOT WATER] or [ZONE1, 2] button is pressed.

The pump operation ends when the following condition is met.
- Pressing the [HOT WATER] or [ZONE1, 2] button stops the about 1 minute later.

The pump operation stops or re-starts as follows:
- Stops for 30 seconds when the operation mode changes.
- Stops the pump when a boiler instruction is given and 70°C ≦ TWI or TWO or THO is met.
- Re-starts the pump when a boiler instruction is given and 65°C > TWI and TWO and THO is met.

Operation when DP_SW10-1 "ON: HP operation only" is selected
- The pump stops only when the hot water cylinder heater is in operation. The pump does not stop with the heating thermostat off.

3-2) Circulation pump (Enhanced pump P2)
Pump type: AC motor, rated voltage 230V, directly connectable to the unit with the rated output of up to 200W. DP_SW10-3 enables the pump P2 to be set either to interlock or non-interlock with the built-in pump P1. Setting to non-interlock sets the pump1 to usual energization.

4) Flow switch operation

Setting the flow switch to On or OFF determines whether water flows in the water heat exchanger.

Model	Criteria for water flowing	Criteria for water not flowing
HWS-802**-E	Flow 13 L/min or more	Flow less than 13 L/min
HWS-1402**-E	Flow 17.5 L/min or more	Flow less than 17.5 L/min

When start the hot water supply, heating, or cooling operation, failure to determine whether water flows does not energize HP, the backup heater, and booster heater. The "A01" error code display also blinks in this case.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	5) Mixing Valve control (2-temperature heating control) To set different radiator unit supply temperatures or floor heating supply temperatures, the unit performs Mixing Valve control. When Mixing Valve "Yes" is selected, the unit controls Mixing Valve every 4 minutes (FC) based on the difference TSC_ΔT between the Zone2 set temperature and TFI (floor inlet water temperature sensor) temperature as follows:

TSC_ΔT	2 ≦ TSC_ΔT	-2 ≦ TSC_ΔT < 2	-2 > TSC_ΔT
Control value	+ 1 step (Open)	± 0 step	- 1 step (Close)

Initial value	Driving range	1 step	Control cycle
6	0-12	3 WV move 7.5 degs	4 mins (FC)

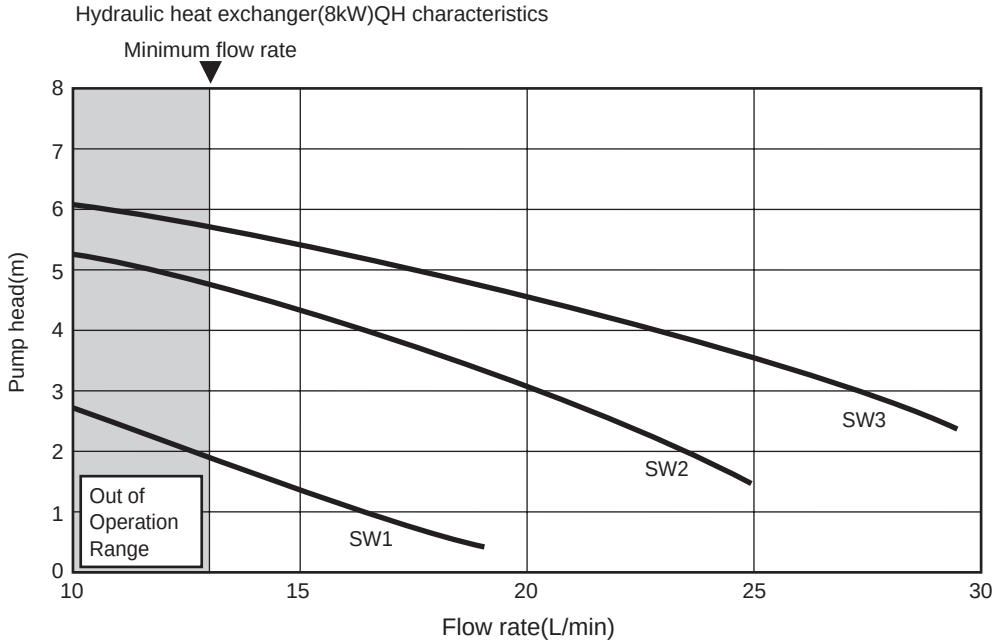
For 2-temperature control, DP_SW12-3 Zone2 "Yes" must be selected.

Related FC

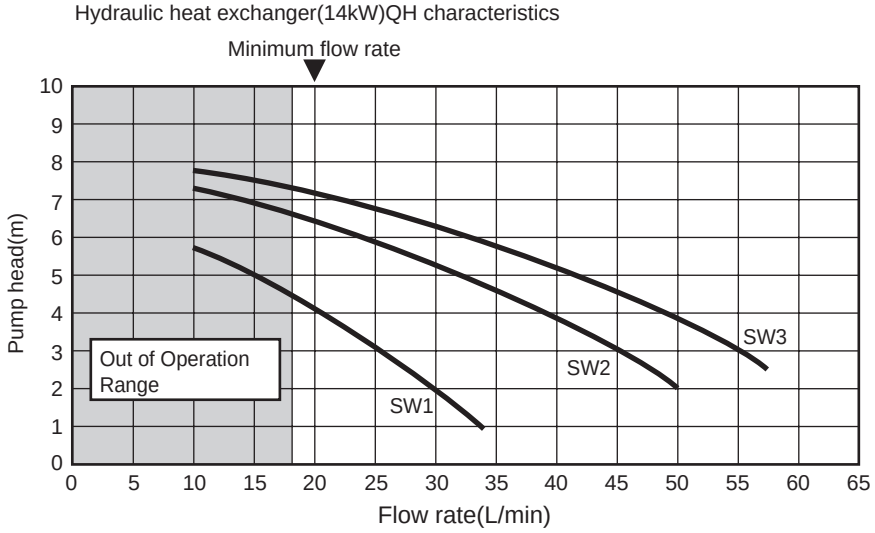
FC No.	Setting item	Default	Setting available range
0C	Mixing Valve operation time	60	30 - 240 secs
59	Mixing Valve control time	4	1 - 30 mins

6) Q-H characteristics of hydro unit
The following shows the Q-H characteristics.

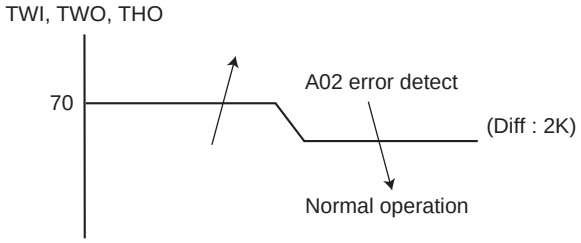
6-1) HWS-801XWHM3-E, T6-E



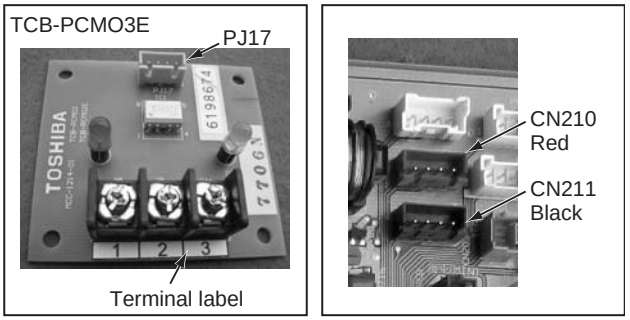
6-2) HWS-1402XWHM3-E, T6-E, T9-E



Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	7) Automatic restart control The unit records operation information before a power outage and retrieves the information after the power is on again to restart automatically the operation with the information. 7-1) Operation during remote controller • The operation status before a power outage automatically restarts after the power is on again. (The merit functions are also enabled) • Approximately 6 hours or more after a power outage The operation status before a power outage automatically restarts after the power is on again. But the merit functions (Night Set Back, Anti Bacteria) are disabled. The remote controller time displays "--:--". (The merit functions are disabled) 7-2) Operation during forcible automatic operation A forcible automatic operation is performed when the power is on again after a power outage. 7-3) Operation during defrosting operation When the power is on again after a power outage, the usual operation restarts. Note: The operation details recorded before a power outage Operation mode: Hot water supply, Heating, Cooling, Hot water supply + Heating, Hot water supply + Cooling Set temperature: Hot water set temperature, Heating set temperature, Cooling set temperature Merit function: Hot water supply operation (Anti Bacteria) Heating operation (Night Set Back)
	8) Piping freeze prevention control This control operates when the power is on regardless the remote controller setting ON or OFF. To prevent frost bursting of the water piping for hot water supply and heating, the unit flows water with the circulation pump when the temperature sensor value falls below a certain temperature. 8-1)Piping freeze prevention control 1 1) Start condition: TWO < 4°C or THWI < 4°C.or THO < 4°C 2) End condition: TWO ≧ 5°C and TWI ≧ 5°C and THO ≧ 5°C 3)-1 How to operate (circulation pump) • When the circulation pump is not in operation, if the sensor detects the freeze prevention control start temperature, the unit operate the circulation pump. • During a freeze prevention operation, a heat pump operation does not start. • When neither [HOT WATER] nor [ZONE1, 2] is in operation, if the end condition is not met when 3 minutes has passed after an operation starts, the unit performs the operation in 3)-2 to prevent freeze. 3)-2 How to operate (circulation pump + backup heater) • When neither [HOT WATER] nor [ZONE1, 2] is in operation, if the end condition is not met when 3 minutes has passed after an operation starts. • End condition: TWO ≧ 5°C and TWI ≧ 5°C and THO ≧ 5°C • Heating with the set temperature 55°C operates. 3)-3 Abnormal stop • If a freeze prevention operation continues for 30 minutes and does not meet the end condition, the operation stops as abnormal stop. (Remote controller check code: A5)

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	8-2) Piping freeze prevention control 2 TC and TWO activates freeze prevention regardless of a heat pump operation mode. 1) Determination condition: TWO>20°C, 2*TC+TWO<-12°C is continuously detected for 30 seconds or longer. Or TWO ≦ 20°C, TC+TWO<4°C is continuously detected for 30 seconds or longer. 2) Determination cancellation conditions • The stop or operation mode is changed by the remote controller • The mode is defrosting at the time of determination At the next time of defrosting, the start condition is not met. • The mode is other than defrosting at the time of determination After cooling, heating, hot water heat pump restarts, the start condition is not met for 10 minutes. 3) Error display • If freeze determination cancellation condition is not met, A4 error is displayed. 8-3) Piping freeze prevention control 3 This control applies only when defrosting is in operation. 1) Determination condition: During defrosting, TWI ≦ 15°C is continuously detected for 30 seconds or longer (After the stop, the unit restarts.) 2) Determination cancellation condition • At the next time of defrosting, the start condition is not met. 3) Error display • If freeze determination cancellation condition is not met, A4 error is displayed. 8-4) Piping freeze prevention control 4 When the value of Ps sensor is low, freeze prevention is activated regardless of a heat pump operation mode. 1) Determination condition: Lo pressure sensor detects PS < 0.2 MPa and 30 seconds passes (defrosting and cooling) (During a defrosting operation for cooling and heating, or hot water supply) Lo pressure sensor detects PS < 0.2 MPa and 10 minutes passes (heating and hot water supply operation) 2) Determination cancellation condition • After a restart, the start condition is not met for 30 minutes. • At the next time of defrosting, the start condition is not met. (Defrosting operation for heating or hot water supply) 3) Error display • If freeze determination cancellation condition is not met, A8 error is displayed. 9) High return water protect control. The hydro unit protects against high return water which made by separate boiler system.  When A02 error appeared, the built-in pump will stop.

Item	Operation flow and applicable data, etc.
3. Hydro Unit Control	10) Room temperature thermostat control (Option board TCB-PCM03E is necessary. Connect the connection cable to the water heat exchange board CN211.) When the room thermostat is connected and heating or cooling operates with DP_SW12-4 set to ON, an room thermostat operation is performed.



10-1)Heating thermostat operation

When the heating room thermostat is OPEN, the usual heating AUTO operation is performed.
After 30 minutes has passed, if the heating room thermostat continues to be in the OPEN status, the operation raises the water temperature by 1 degree every 30 minutes. The same heater control as that of the usual HP operation applies to the backup heater and booster heater.

When the heating room thermostat is CLOSE, the heat pump performs thermostat off. During the thermostat off, the operation lowers the set water temperature by 1 deg every 30 minutes. When the thermostat off is completed, the backup heater and booster heater stops being energized.

10-2)Cooling thermostat operation

When the cooling room thermostat is CLOSE, the usual cooling operation is performed. (Initial set water temperature 20°C)
After 30 minutes has passed, if the room thermostat continues to be in the OPEN status, the operation lowers the water temperature by 1°C every 30 minutes.

When the cooling room thermostat is OPEN, the heat pump performs thermostat off. During the thermostat off, the operation raises the set water temperature by 1 degree every 30 minutes.

Indoor thermostat contact point	Correction control	Heating operation	Cooling operation
OPEN	Setting shift UP	Thermostat ON Up water temperature by 1 deg every 30 mins	Thermostat OFF Lower water temperature by 1 deg every 30 mins
CLOSE	Setting shift DOWN	Thermostat OFF Lower water temperature by 1 deg every 30 mins	Thermostat ON Up water temperature by 1 deg every 30 mins

11) Forcible stop control (Option board TCB-PCMO3E is necessary. Connect the connection cable to the water heat exchange board CN210.)
- When CLOSE occurs between "HEAT" and "COM" of TCB-PCM03E, the RED LED on the option board lights and the operation (hot water supply, heating, cooling) stops. To restart the operation, use the operation button of the remote controller.

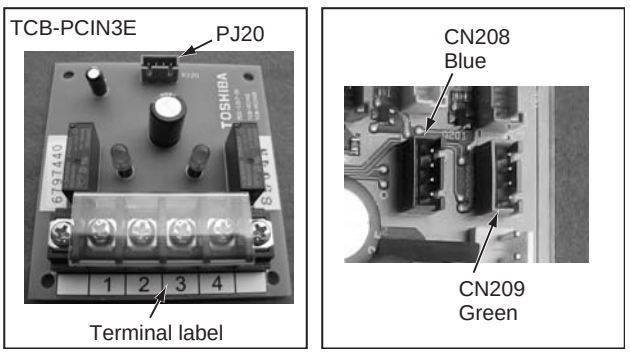
12) Output signal control 1 (Option board TCB-PCIN3E is necessary. Connect the connection cable to the water heat exchange board CN208.)

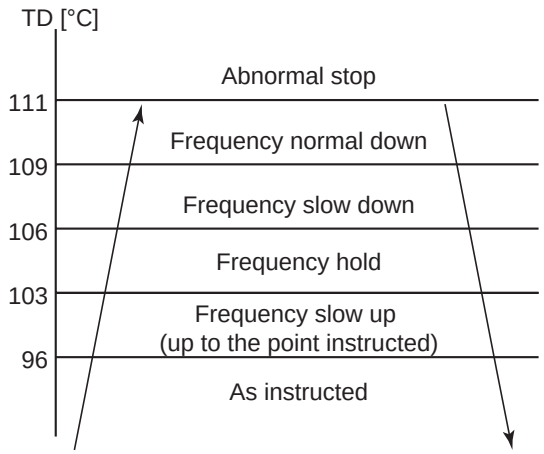
- If an error detecting signal is output, CLOSE occurs between the terminal 1 and 2.
- If a boiler output signal is output, CLOSE occurs between the terminal 3 and 4.
- In either signal above is output, the red LED on the Option board lights.

13) Output signal control 2 (Option board TCB-PCIN3E is necessary. Connect the connection cable to the water heat exchange board CN209.)

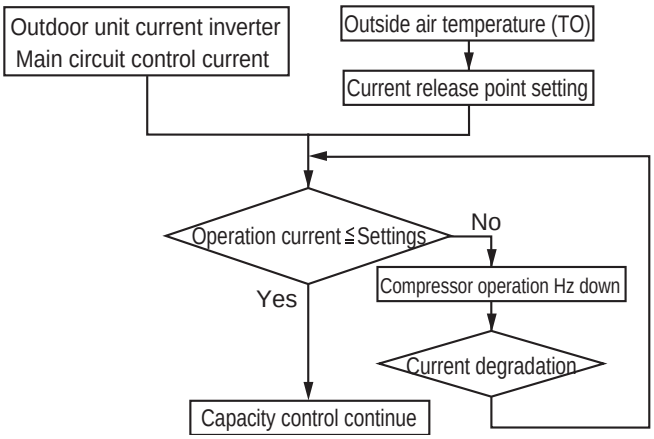
- When defrosting is in operation, CLOSE occurs between the terminal 1 and 2.
- When the compressor is in operation, CLOSE occurs between the terminal 3 and 4.

In either signal above is output, the red LED on the OP board lights.



Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	1) PMV (Pulse motor valve) control Valve opening is controlled using the expansion valve with a pulse motor according to a heat pump operation status. • PMV is controlled between 30 and 500 pulses during an operation. • At the time of a cooling operation, PMV is controlled with the usual target value of 1 to 4 K temperature difference between TS sensor and TC sensor. • At the time of a hot water supply or heating operation, PMV is controlled with the usual target value of 2 to 4 K (for 802H-E) or -1 to 4 K (for 1102, 1402H-E) temperature difference between TS sensor and TE sensor. • For both cooling and heating, if the cycle is overheated, PMV is controlled using the TD sensor.The usual target value is 91°C for a cooling operation, and 96°C for a heating operation. * A defective sensor may cause liquid back flow or abnormal overheat of the compressor, significantly shortening the compressor life. If the compressor or other equipment is repaired, first check that the resistance of each sensor or the refrigerant cycle has no problem, then start the operation.
	2) Discharge temperature release control This control detects an abnormality of the refrigerant cycle or compressor to perform failure prevention. • This control reduces operation frequency if the PMV control does not lower the outlet temperature or if the outlet temperature rapidly rises. The frequency control is broken down to the unit of 0.6 Hz to stabilize the cycle. • If the discharge temperature detects the abnormal stop zone, the compressor stops and then restarts after 150 seconds. The abnormality detection counter is cleared when the operation continues for 10 minutes. If detected 4 times, the error code is displayed and the compressor does not restart. * An abnormality could occur due to too less refrigerant, PMV defective, or cycle stuck. • For details about an error displayed, see the check code list. 

Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	3) Current release control The number of compressor rotation is controlled so that current value of the compressor drive circuit does not exceed the specified value. • The outdoor unit detects the input current. • The outside air temperature is detected and used to set the specified value of current. • The number of compressor rotation instructed by the hydro unit is used to determine whether the current value exceeds the specified value. • If exceeds, the number of compressor rotation is reduced to the most approximate number instructed by the hydro unit within the specified value range.



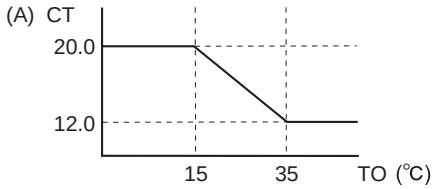
Heating

Outside temperature TO (degree °C)	Current release value (A)	
	802H-E	1102, 1402H-E
35 ≦ TO	12.0	12.0
15 ≦ TO < 35	20.0 - (To - 15) × 0.4	20.0 - (To - 15) × 0.4
TO < 15	20.0	20.0

Cooling

Outside temperature TO (degree °C)	Current release value (A)	
	802H-E	1102, 1402H-E
44 ≦ TO	9.5	15.0
39 ≦ TO < 44	13.0	17.7
10 ≦ TO < 39	16.0	20.0

No cooling operation available for TO < 10°C.



4) Current releases shift control
During a cooling operation, this control prevents the electronic parts, such as a compressor drive element, and compressor from failing.

• The current release control value (I) is selected from the following table according to the TO sensor value.

Current release control value (I)

Temperature range	802H-E	1102H-E	1402H-E
50°C ≦ TO	10.5	14.1	14.1
45°C ≦ TO < 50°C	10.5	14.1	14.1
39°C ≦ TO < 45°C	14.0	14.1	16.4
TO < 39°C	16.0	14.1	16.4
TO abnormal	10.5	14.1	14.1

Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	5) Outdoor fan control The outdoor side control part controls the number of fan motor rotations by receiving an operation instruction from the indoor side (Hydro unit) control part. * Although the fan motor is a DC motor, which has non-step variable numbers of rotations, it is limited to some steps for convenience of control.

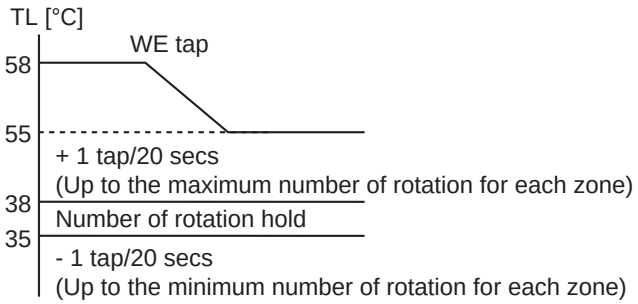
The number of fan tap rotation allocation [rpm]

		W1	W2	W3	W4	W5	W6	W7	W8
802H-E		200	230	260	300	340	380	420	460
1102, 1402H-E	Upper	200	240	240	260	320	380	480	500
	Lower	200	200	200	280	360	400	500	520

		W9	WA	WB	WC	WD	WE	WF
802H-E		520	570	600	630	670	710	740
1102, 1402H-E	Upper	530	610	640	660	720	780	890
	Lower	550	630	660	700	740	820	910

5-1) Cooling fan control

- The TL sensor, TO sensor and operation frequency control the outdoor fan. The control is performed by 1 tap of the DC fan control (14 taps).
- For 60 seconds after the start, the maximum fan tap for each zone that is shown in the following table is fixed. After that, the fan is controlled according to the TL sensor temperature.



HWS-802H-E

Temperature range	Less than 20 Hz		20 Hz or more to less than 45 Hz		45 Hz or more	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
38°C ≦ TO	W6	WC	W8	WE	WA	WE
29°C ≦ TO < 38°C	W5	WB	W7	WD	W9	WD
15°C ≦ TO < 29°C	W4	W8	W6	WA	W8	WC
5°C ≦ TO < 15°C	W3	W6	W5	W8	W7	WA
0°C ≦ TO < 5°C	W2	W4	W4	W6	W5	W8
-4°C ≦ TO < 0°C	W2	W3	W3	W5	W4	W6
TO < -4°C	OFF	OFF	OFF	W2	OFF	W3
TO abnormal	OFF	WC	OFF	WE	OFF	WE

HWS-1102H-E, 1402H-E

Temperature range	Less than 20 Hz		20 Hz or more to less than 45 Hz		45 Hz or more	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
38°C ≦ TO	W6	WC	W8	WC	WA	WD
29°C ≦ TO < 38°C	W5	WB	W7	WC (WB for 1102)	W9	WC
15°C ≦ TO < 29°C	W4	W8	W6	WA	W8	WC
5°C ≦ TO < 15°C	W3	W6	W5	W8	W7	WA
0°C ≦ TO < 5°C	W2	W4	W4	W6	W5	W8
-4°C ≦ TO < 0°C	W2	W3	W3	W5	W4	W6
TO < -4°C	W1	W2	W1	W4	W2	W6
TO abnormal	W1	WC	W1	WC	W2	WD

Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	5-2) Hot water supply and heating fan control

1) The TE sensor, TO sensor and operation frequency control the outdoor fan. (The minimum W1 to the maximum are controlled according to the table below.)
2) For 3 minutes after the start, the maximum fan tap for each zone that is shown in the following table is fixed. After that, the fan is controlled according to the TE sensor temperature.
3) If TE ≧ 24°C continues for 5 minutes, the operation stops. No error code is displayed for this; the status is the same as the usual thermostat off. The operation restarts after 150 seconds. This intermittent running is not abnormal.
4) If the situation in 3) frequently occurs, the possible cause is that the filter in the air inlet part of the hydro unit is dusty. Clean the filter, and restart the operation.

TE [°C]

-2 tap/20 secs (to W1)
Stop time count

24

-2 tap/20 secs (to W1)

21

-1 tap/20 secs (to W1)

18

Number of revolutions hold

15

+ 1 tap/20 secs
(Up to the maximum tap for each zone)

For 802H-E

Temperature range	Less than 20 Hz	20 Hz or more to less than 45 Hz	45 Hz or more
	Maximum	Maximum	Maximum
10°C ≦ TO	W7	W8	W9
5°C ≦ TO < 10°C	W9	WB	WD
-3°C ≦ TO < 5°C	WD	WD	WE
-10°C ≦ TO < -3°C	WE	WE	WE
TO < -10°C	WF	WF	WF
TO abnormal	WF	WF	WF

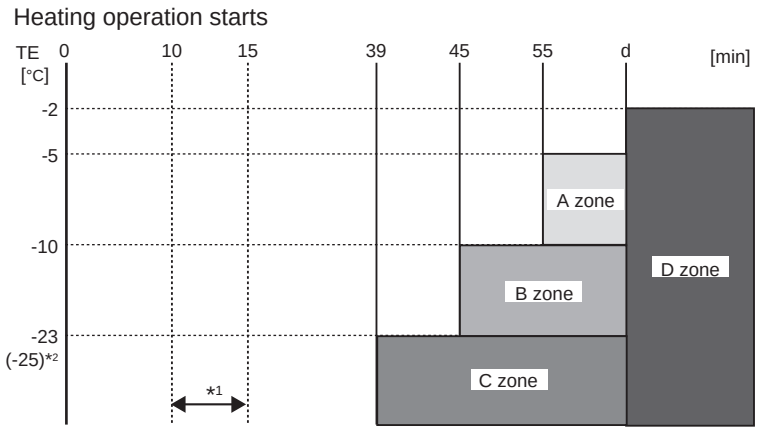
For 1102H-E

Temperature range	Less than 20 Hz	20 Hz or more to less than 45 Hz	45 Hz or more
	Maximum	Maximum	Maximum
10°C ≦ TO	W7	W8	W9
5°C ≦ TO < 10°C	W9	WA	WA
-3°C ≦ TO < 5°C	WA	WA	WB
-10°C ≦ TO < -3°C	WB	WB	WB
TO < -10°C	WD	WD	WD
TO abnormal	WD	WD	WD

For 1402H-E

Temperature range	Less than 20 Hz	20 Hz or more to less than 45 Hz	45 Hz or more
	Maximum	Maximum	Maximum
10°C ≦ TO	W7	W8	W9
5°C ≦ TO < 10°C	W9	WA	WB
-3°C ≦ TO < 5°C	WB	WB	WC
-10°C ≦ TO < -3°C	WC	WC	WC
TO < -10°C	WD	WD	WD
TO abnormal	WD	WD	WD

Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	6) Defrosting control This control defrosts the outdoor heat exchanger. The temperature sensor (TE sensor) of the outdoor heat exchanger determines frost formation, and then defrosting is performed in the 4-way valve reverse defrosting method. 1) During a heating operation, defrosting is performed when the TE sensor meets any of the conditions in A through D zones. 2) During defrosting, when TE sensor maintains 12°C or higher for 3 seconds or 7°C ≦ TE < 12°C for a minute, the defrosting ends. Also, when defrosting continues for 10 minutes even if the TE sensor temperature is below 7°C, the defrosting ends. 3) After the defrosting, stop the compressor for approx. 40 seconds before starting a heating operation. 4) Switching the jumper "J805" and "J806" of the outdoor control board can change the time of d above mentioned. (Factory setting: 150 minutes)



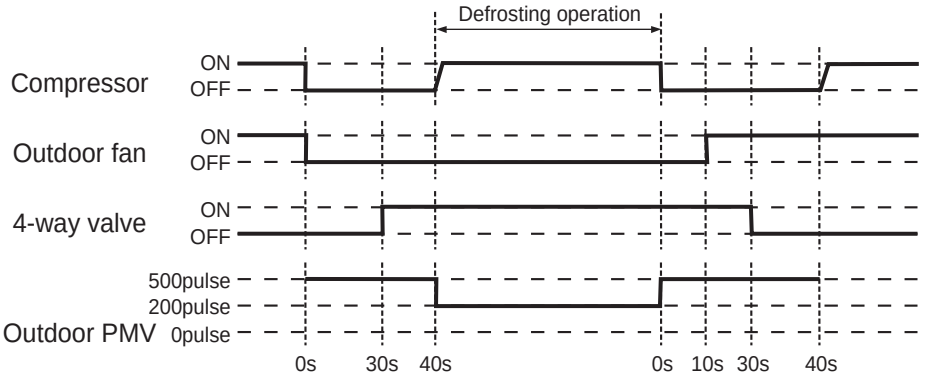
*1 In 10 to 15 minutes after the heating operation starts, the lowest value of TE is recorded as TEO, and the lowest temperature of To as ToO.
*2 Inside brackets: For 802H-E

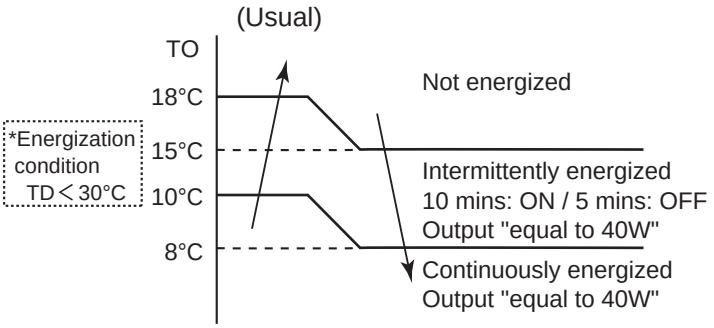
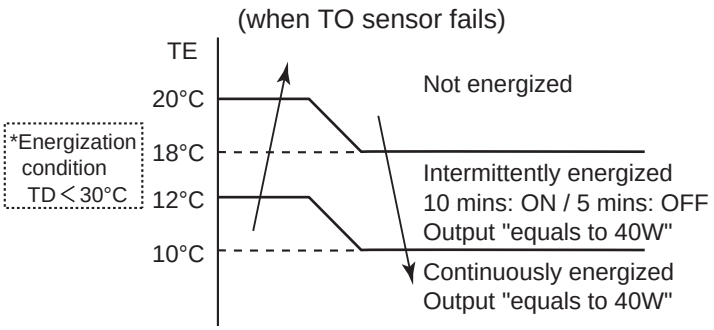
	To Normal
A Zone	Maintain " (TEO - TE) - (ToO - To) ≧ 3°C" for 20 secs
B Zone	Maintain " (TEO - TE) - (ToO - To) ≧ 2°C" for 20 secs
C Zone	Maintain " TE ≦ -23°C" for 20 secs (1102, 1402H-E) Maintain " TE < -25°C" for 20 secs (802H-E)
D Zone	Accumulate compressor operation status of TE < -2°C for 150 mins

	To Normal
A Zone	Maintain " TEO - TE ≧ 3°C" for 20 secs
B Zone	Maintain " TEO - TE ≧ 2°C" for 20 secs
C Zone	Maintain " TE ≦ -23°C" for 20 secs (1102, 1402H-E) Maintain " TE < -25°C" for 20 secs (802H-E)
D Zone	Accumulate compressor operation status of TE < -2°C for 150 mins

Jumper switching O: Short circuit ×: Open

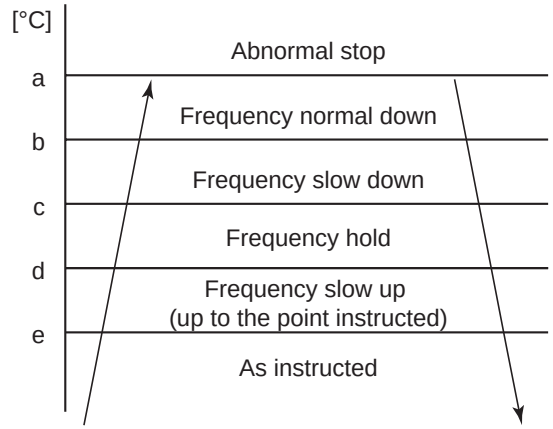
J805	J806	d (1102,1402H-E)	d (802H-E)
O	O	150 mins (Factory setting)	150 mins (Factory setting)
O	×	90 mins	90 mins
×	O	60 mins	60 mins
×	×	30 mins	30 mins



Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	7) Winding heating control 1) This control energizes the inactive compressor instead of the case heater to warm the compressor. The purpose is to prevent the refrigerant from staying inside the compressor. 2) After the unit is installed, failure to perform energization for the given time period may cause the compressor to fail. Also, when starting an operation long after the power left off, first energize the compressor before starting the operation in the same way as a trial run. 3) Energization is determined by the TD sensor and TO sensor. If the TO sensor fails, the TE sensor automatically takes over the operation. Determine whether the TO sensor fails by checking the LED outside. 4) If TD is 30°C or higher, the energization stops.   Notes During winding energization, energizing noise may be heard, but this is not abnormal.
	8) Short circuit operation prevention control 1) In 10 minutes after the operation start, the compressor may not stop for protection. This status is not abnormal. (The operation duration time of the compressor varies depending on a operation status.) 2) If the operation stops with the remote controller, the operation does not continue.
	9) Over current protection control 1) A detection of abnormal current with the over current protection control stops the compressor. 2) Set the abnormality detection counter to 1, and restarts the compressor after 150 seconds. 3) When the stop by over current protection control counts 8 times, error code is displayed and the compressor does not restart. (Remote controller error code display: HO1)

Item	Operation flow and applicable data, etc.
8-4. Outdoor unit control	10) High temperature release control 1) To prevent excessive hi pressure rise, operation frequency is controlled by the TL sensor when cooling and by TWO sensor when heating. 2) If the TL sensor when cooling or the TWO sensor when heating detects an abnormal stop zone temperature, the compressor stops and the abnormality detection counter increments. 3) When the compressor stops in 2), the operation restarts when the temperature returns to the usual operation zone ("e" or below) after 150 seconds. 4) When the compressor stops in 2), the abnormality detection counter is cleared when the operation continues for 10 minutes. If the counter counts 10 times, error code is displayed and the compressor does not restart. 5) For details about an check code displayed, see the check code list.

Heating TC
Cooling TL



	802H-E		1102H-E, 1402H-E	
	Heating	Cooling	Heating	Cooling
	TC (TWO+2)	TL	TC (TWO+2)	TL
a	61°C	63°C	62°C	63°C
b	56°C	62°C	57°C	62°C
c	54°C	60°C	55°C	60°C
d	52°C	58°C	53°C	58°C
e	48°C	54°C	49°C	54°C

9 Method of Defect Diagnosis

In order to diagnose the defective part of the heat pump system, first understand the symptom of the defect.
(1) Check the operation status. (It does not move, or it moves but stops, etc.)
(2) Flashing display on the display part of the hydro unit.
(3) Check the “check code” by the remote control.

Please refer to the following procedure of defect diagnosis for the identification.

No.	Procedure of defect diagnosis		Remark
9-1	Matters to be confirmed first	9-1-1 Check the power supply voltage 9-1-2 Check for any miswiring of the connection cables between the hydro unit and the outdoor unit 9-1-3 About the installation of the temperature sensor	Check the power supply for the heat pump hot water heater, the crossover between the hydro unit and the outdoor unit, and the installation of temperature sensors.
9-2	Non-defective operation (program operation)		Non-defective program operations for the protection of the heat pump unit.
9-3	Outline of the determination diagram	9-3-1 Procedure of defect diagnosis 9-3-2 How to determine from the check code display on the remote controller 9-3-3 How to cancel a check code on the remote controller 9-3-4 How to diagnose by error code	With reference to the "check code", roughly identify the defect from the defect diagnosis for the heat pump hot water heater and determine the defective part from individual symptoms.
9-4	Diagnosis flow chart for each error code	9-4-1 Hydro unit failure detection 9-4-2 Outdoor unit failure detection 9-4-3 Temperature sensor, temperature-resistance characteristic table	
9-5	Operation check by PC board	9-5-1 Operation check mode	The operation check mode allows to determine good or not by checking the operation of the 4-way valve, 2-way valve and pulse motor valve.
9-6	Brief method for checking the key components	9-6-1 Hydro unit 9-6-2 Outdoor unit	How to determine the presence of any defect particularly in functional parts.

9-1. Matters to be confirmed first

9-1-1. Check the power supply voltage

Check that the power supply voltage is AC230 V±23 V. If the power supply voltage is not in this range, it may not operate normally.

9-1-2. Check for any miswiring of the connection cables between the hydro unit and the outdoor unit

The hydro unit and the outdoor unit are connected with three connection cables. Make sure the interconnecting connections between the hydro unit and the outdoor unit terminal blocks are connected to the correct terminal numbers. If not connected correctly, the heat pump system does not operate. However, a miswiring would not cause damage to the equipment.

9-1-3. About the installation of the temperature sensor

If each sensor is removed due to the replacement of the water heat exchange or inverter board, or the replacement of the refrigeration cycle parts, make sure to put the sensor back to the position where it was before.

- Each sensor position has a marking. Make sure to put it back to the exact position.
- Make sure to install it with a sensor holder so that the temperature sensing part of the sensor and the straight part of the copper piping are attached with each other tightly.
- If the installation of the sensor is incomplete or the installed position is wrong, it will not perform a normal control operation and may cause a defect such as a malfunction of the equipment or an occurrence of an abnormal sound, etc.

9-2. Non-defective operation (program operation) … No fault code display appears.

In order to control the heat pump unit, there are the following operations as the built-in program operations in the microcomputer. If a claim occurs about the operation, please confirm whether it falls under any of the contents in the following table.
If it does, please understand that the symptom is not a defect of the equipment, and it is an operation necessary for the control and maintenance of the heat pump unit.

Table 9-2-1 Non-defective operation

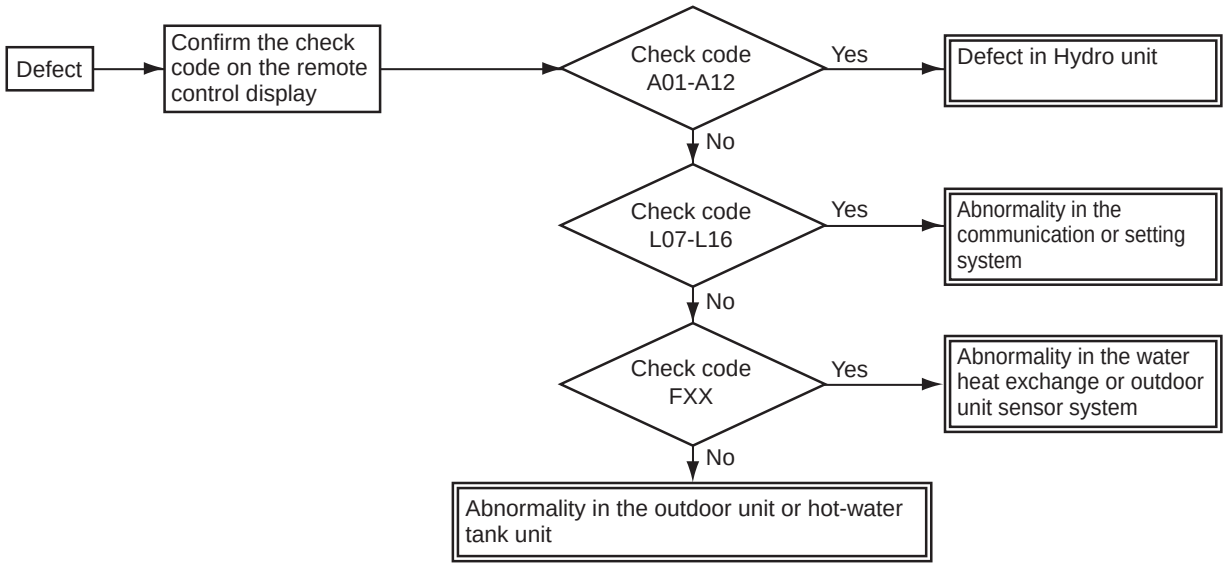
No.	Operation of the heat pump system	Explanation
1	The compressor sometimes does not operate even within the range of compressor “ON”.	The compressor does not operate during the operation of the compressor reboot timer (3 min). Even after the power activation, the compressor reboot timer continues to be active.
2	During the hot water supply or heating operation, without reaching the set temperature, the compressor operation frequency stays at a frequency of less than the maximum Hz or lowers down.	It may be caused by the high temperature release control (release protection control by the temperature of the water heat exchanger) or the current release control.
3	The “Stop” operation on the remote control will not stop the circulating pump. (The same for hot water supply, heating and cooling)	In order to deal with the temperature increase in the heat exchanger after stopping, the operation continues for 1 min after the compressor is stopped.
4	“ON” on the remote control will not operate the compressor. (It will not operate even after the reboot delay timer elapsed)	When the outdoor temperature (TO sensor detection temperature) is -20°C or lower, the heat pump will not operate in order to protect the compressor, and the heater will operate instead.
5	When the power is turned on, it starts operation without operating the remote control.	• The auto restart operation may be working. • The antifreeze operation may be working. • If the TWI, TWO or THO sensor detects a temperature below 4°C, the operation changes from circulating pump --->> circulating pump + heater.)

9-3. Outline of the determination diagram

The first determination of whether a defective part is in the hydro unit or the outdoor unit can be performed by the following method.

9-3-1. Procedure of defect diagnosis

In the case of a defect, please apply the following procedure in order to find the defective part.



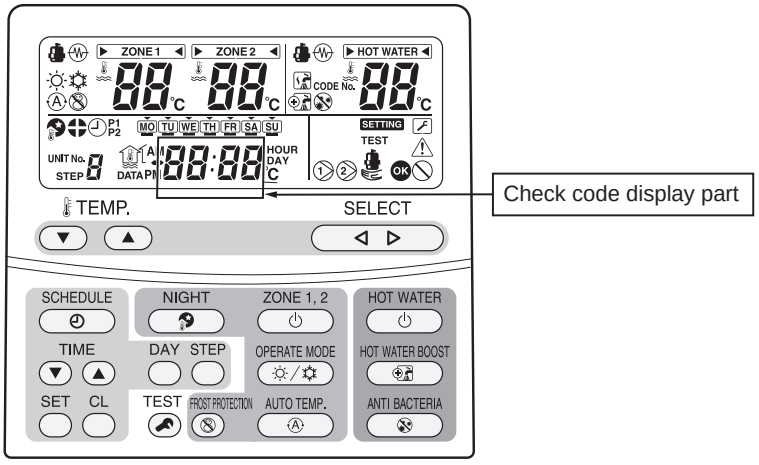
9-3-2. How to determine from the check code on the remote control

If the defect is limited by the check code displayed on the remote control, please repair the defect based on the table on the next page.

The check codes are separated into two groups: software and hardware errors.

Since a hardware error cannot be cancelled without a part replacement etc., please perform a repair.

If its abnormality is determined, the abnormality is noticed by indicating the check code on the remote control check code display part while letting off a buzzer.



9-3-3. How to cancel a check code on the remote controller

(1) Press ZONE1,2 or HOT WATER button (on the operation side) to clear the check code.

(2) Press CL to stop a buzzer for an abnormality only.

Although the above procedure cancels the check code, the hardware error will be displayed again until the hardware repair is completed.

9-3-4. How to diagnose by error code

Defect mode detected by the water heat exchange

O ... Possible
× .... Not possible

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
A01	**Pump or flowing quantity error** 1) Detected by TC sensor TC≧63°C is detected in the heating or hot water supply heat pump operation (except for defrosting).	×	×	1. Almost no or little water flow. • Not enough vent air • Dirt clogging in the water piping system. • The water piping is too long. • Installation of buffer tank and secondary pump	4	74
	2) Detected by flow switch abnormality When no signal of the flow switch is showing 2 min after the built-in pump operation started.				2	74
	3) Detection of chattering abnormality in the flow switch input Chattering detection: Detects input changes (OFF⇔ON) 4 times within 10 seconds during operation.				4	74
	4) Disconnection of the flow switch connector When the stopped built-in pump starts its operation, the flow switch status is detecting "water flow".			1. Disconnection of the flow switch connector. 2. Defect of the flow switch.	2	74
A02	**Temperature increase error** (heating) When one of the TWI, TWO and THO sensors exceeds 70°C.	Heating O Hot water ×	O	1. Check the water inlet, water outlet and heater outlet (TWI, TWO, THO) sensors. 2. Defect of the backup heater (defect automatic reset thermostat).	1	75
A03	**Temperature increase error** (hot water supply) When the TTW sensor exceeds 85°C.	Heating O Hot water ×	O	1. Check the hot water cylinder sensor (TTW). 2. Check the hot water cylinder thermal cut-out.	1	76
A04	**Antifreeze operation** 1)TWO>20°C condition: 2×TC+TWO < -12°C is detected. 2)TWO≦20°C condition: TC+TWO < 4°C is detected. 3)TWI≦10°C is detected during defrosting.	O	×	1. Almost no or little water flow. • Dirt clogging in the water piping system. • The water piping is too long. 2. Check the heater power circuit. • Power supply voltage, breaker, power supply connection 3. Set the presence of the backup heater. 4. Check the water inlet, water outlet and heat exchange (TWI, TWO, TC) sensors.	Heating2 Hot water2 Cooling4	77
A05	**Piping antifreeze operation** Activating the heater under the condition of TWO<4orTWI<4orTHO<4 does not achieve TWO,TWI,THO≧5°C after 30 min elapsed.	O	O	1. Check the heater power circuit. • Power supply voltage, breaker, power supply connection 2. Check the water inlet, water outlet and heater outlet sensors (TWI,. TWO, THO). 3. Disconnection of the backup heater.	1	78

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
A07	**Pressure switch operation** The pressure switch operates for 300 sec continuously during the heat pump operation.	O	×	1. Almost no or little water flow. 2. Defect of the flow switch. 3. On-load operation under the above conditions. 4. Defect in the pressure switch.	1	79
A08	**Low pressure sensor operation error** The low pressure sensor detected 0.2 MPa or less.	O	×	1. Almost no or little water flow. 2. Defect of the flow switch. 3. On-load cooling or prolonged defrosting (a lot of frost formation) under the above conditions.	8	80
				4. Defect in the low pressure sensor.	2	
A09	**Overheat protection operation** When the thermostat of the backup heater activates during the operation of the heat pump or backup heater. When the thermostat operation is activated while it has been stopped.	O	×	1. No water (heating without water) or no water flow. 2. Defect of the flow switch.	2	81
				3. Defect of the backup heater (poor automatic reset thermostat).	1	
A11	**Operation of the release protection** When the TWO release counts to 10.	Heating Cooling × Hot water O	×	1. Almost no water flow. 2. Defect of the flow switch. 3. Check the water outlet temperature sensor (TWO).	10	82
A12	**Heating, hot water heater** The antifreeze control is detected under the condition of TWI<20°C while TWI>15°C, TTW>20°C is not detected after the heater backup.	O	O	1. Activated by a large load of heating or hot water supply. 2. Check the heater power circuit (backup or hot water cylinder heater). • Power supply voltage, breaker, power supply connection	1	83
E03	**Regular communication error between hydro unit and remote controller** When there is no regular communication from the remote control for 3 min, or when no remote control is equipped.	×	O	1. Check remote control connection. 2. Defect in the remote control.	1	—
E04	**Regular communication error between hydro unit and outdoor unit** The serial signal cannot be received from outdoor.	O	O	1. Check the serial circuit. • Miswiring of the crossover between the water heat exchanger and the outdoor unit	1	84
F03	**TC sensor error** Open or short circuit in the heat exchange temperature sensor.	O	O	1. Check the resistance value and connection of the heat exchange temperature sensor (TC).	1	85
F10	**TWI sensor error** Open or short circuit in the water inlet temperature sensor.	O	O	1. Check the resistance value and connection of the water inlet temperature sensor (TWI).	1	86
F11	**TWO sensor error** Open or short circuit in the water outlet temperature sensor.	×	O	1. Check the resistance value and connection of the water outlet temperature sensor (TWO).	1	87
F14	**TTW sensor error** Open or short circuit in the hot water cylinder sensor.	×	O	1. Check the resistance value and connection of the hot water cylinder sensor (TTW).	1	87

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
F17	**TFI sensor error** Open or short circuit in the floor temperature sensor.	×	O	1. Check the resistance value and disconnection of the floor-inlet temperature sensor (TFI).	1	87
F18	**THO sensor error** Open or short circuit in the heater outlet temperature sensor.	×	O	1. Check the resistance value and disconnection of the heater outlet temperature sensor (THO).	1	88
F19	**Detection of THO disconnection error** When TWO–THO>15K is detected and 30 sec elapsed.	×	×	1. Check for any disconnection of the heater outlet temperature sensor (THO).	1	88
F20	**TFI sensor error** When TWO–TFI>30K is detected and TFI<TWI–5K is detected.	×	×	1. Check any disconnection of the floor-inlet temperature sensor (TFI).	1	89
F23	**Low pressure sensor error** When PS<0.07 MPa is detected for 2 sec or more.	O	O	1. Check for any disconnection (body or connection wiring) of the low pressure sensor. 2. Check the resistance value of the low pressure sensor.	1	89
F29	**EEROM error** Inconsistency is detected once without verify ACK after writing to EEPROM.	×	×	1. Replace the water heat exchange control board.	1	90
F30	**Extended IC error** When the extended IC is abnormal.	×	×	1. Replace the water heat exchange control board.	1	90
L07	**Communication error** Individual hydro units have a group line.	×	×	1. Replace the water heat exchange control board.	1	90
L09	**Communication error** The capability of the hydro unit has not been set.	×	×	1. Check the setting of the FC01 capability specifications. HWS-802xx-E = 0012 HWS-1402xx-E = 0017	1	90
L16	**Setting error** When ZONE1 has not been set, while ZONE2 has been set.	×	×	1. Check the body DP-SW12_2,3.	1	90

Defect mode detected by the outdoor unit

O ... Possible
× .... Not possible

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
F04	**TD sensor error** Open or short circuit in the discharge temperature sensor.	O	×	1. Check the resistance value and connection of the discharge sensor (TD).	1	85 99
F06	**TE sensor error** Open or short circuit in the heat exchange temperature sensor.	O	×	1. Check the resistance value and connection of the heat exchange temperature sensor (TE).	1	85 99
F07	**TL sensor error** Open or short circuit in the heat exchange temperature sensor.	O	×	1. Check the resistance value and connection of the heat exchange temperature sensor (TL).	1	86 99
F08	**TO sensor error** Open or short circuit in the outdoor temperature sensor.	O	×	1. Check the resistance value and connection of the outdoor temperature sensor (TO).	1	86 99
F12	**TS sensor error** Open or short circuit in the suction temperature sensor.	O	×	1. Check the resistance value and connection of the suction temperature sensor (TS).	1	100
F13	**TH sensor error** Open or short circuit in the heat-sink temperature sensor.	O	×	1. Check the resistance value and connection of the heat-sink temperature sensor (TH).	1	100
F15	**TE, TS sensors error** Open or short circuit in the temperature sensors.	O	×	1. Check for any wrong installation of the heat exchange temperature sensor (TE) and the suction temperature sensor (TS).	1	100
F31	**EEPROM error**	O	×		1	100
H01	**Compressor breakdown** 1 When the operation frequency lowers due to the current release 40 sec or later after the compressor activation and it stops by underrunning the minimum frequency. 2 When the operation frequency lowers due to the current limit control and it stops by underrunning the minimum frequency. 3 When an excess current is detected 0.8 sec or later after the compressor activation.	O	×	1. Check the power supply voltage (AC230 V±23 V). 2. Over-loaded condition of the refrigeration cycle. 3. Check that the service valve is fully open.	8	91
H02	**Compressor lock** 1 When the input current is more than zero 20 sec or later after the compressor activation and the activation has not been completed.	O	×	1. Defect of compressor (lock) – Replace the compressor. 2. Defect of compressor wiring (open phase).	8	92
H03	**Defect in the current detection circuit**	O	×	1. Replace the outdoor inverter control board.	8	92

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
H04	**Operation of case thermostat** When the case thermostat exceeds 125°C.	O	×	1. Check the refrigeration cycle (gas leak). 2. Check the case thermostat and connector. 3. Check that the service valve is fully open. 4. Defect of the pulse motor valve. 5. Check for a kinked piping.	4	92
L10	**Unset service PC board jumper** Jumpers J800-J803 have not been cut.	O	×	1. Cut J800-J803.	1	92
L29	**The communication between the outdoor PC board MUCs error** No communication signal between IPDU and CDB.	O	×	1. Replace the outdoor control board.	1	93
P03	**The outlet temperature error** When the discharge temperature sensor (TD) exceeds 111°C.	O	×	1. Check the refrigeration cycle (gas leak). 2. Defect of the pulse motor valve. 3. Check the resistance value of the discharge temperature sensor (TD).	4	94
P04	**The high pressure switch error**	O	×		10	94
P05	**The power supply voltage error** When the power supply voltage is extremely high or low.	O	×	1. Check the power supply voltage. (AC230 V±23 V)	4	94
P07	**Overheating of heat-sink error** When the heat-sink exceeds 105°C.	O	×	1. Check the thread fastening and heat-sink grease between the outdoor control board and the heat-sink. 2. Check the heat-sink fan duct. 3. Check the resistance value of the heat-sink temperature sensor (TH).	4	95
P15	**Detection of gas leak** When the discharge temperature sensor (TD) exceeds 106°C for consecutive 10 min. When the suction temperature sensor (TS) exceeds 60°C for cooling or 40°C for heating for 10 consecutive min.	O	×	1. Check the refrigeration cycle (gas leak). 2. Check that the service valve is fully open. 3. Defect of the pulse motor valve. 4. Check for a kinked piping. 5. Check the resistance value of the discharge temperature sensor (TD) and the suction temperature sensor (TS).	4	95
P19	**The 4-way valve inversion error** When the heat exchange temperature sensor (TE) exceeds 30°C or the suction temperature sensor (TS) exceeds 50°C during the heat pump operation.	O	×	1. Check the operation of the 4-way valve unit or the coil characteristics. 2. Defect of the pulse motor valve. 3. Check the resistance value of the heat exchange temperature sensor (TE) and the suction temperature sensor (TS).	4	96

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup present	Automatic reset			
P20	**High pressure protection operation** When an abnormal stop occurs due to the high pressure release control. When the heat exchange temperature sensor (TL) detects 63°C during the cooling operation. When the water outlet sensor (TWO) detects 60°C during the heating or hot water supply operation.	O	×	1. Check that the service valve is fully open. 2. Defect of the pulse motor valve. 3. Check the outdoor fan system (including clogging). 4. Over-filling of refrigerant. 5. Check the resistance value of the heat exchange temperature sensor (TL) and the water outlet temperature sensor (TWO).	10	97
P22	**Outdoor fan system error** When a DC fan rotor position detection NG, element short circuit, loss of synchronization, or abnormal motor current occurs.	O	×	1. Check the lock status of the motor fan. 2. Check the connection of the fan motor cable connector. 3. Check the power supply voltage (AC230 V±23 V).	1-4	98
P26	**Short circuit of the compressor driver element error** When an abnormal short circuit of IGBT is detected.	O	×	1. P26 abnormality occurs when operating with the compressor wiring disconnected … Check the control board. 2. No abnormality occurs when operating with the compressor wiring disconnected … Compressor rare short.	8	98
P29	**Compressor rotor position error** The rotor position in the compressor cannot be detected.	O	×	1. Even if the connection lead wire of the compressor is disconnected, it stops due to an abnormality in the position detection … Replace the inverter control board. 2. Check the wire wound resistor of the compressor. Short circuit … Replace the compressor.	8	98

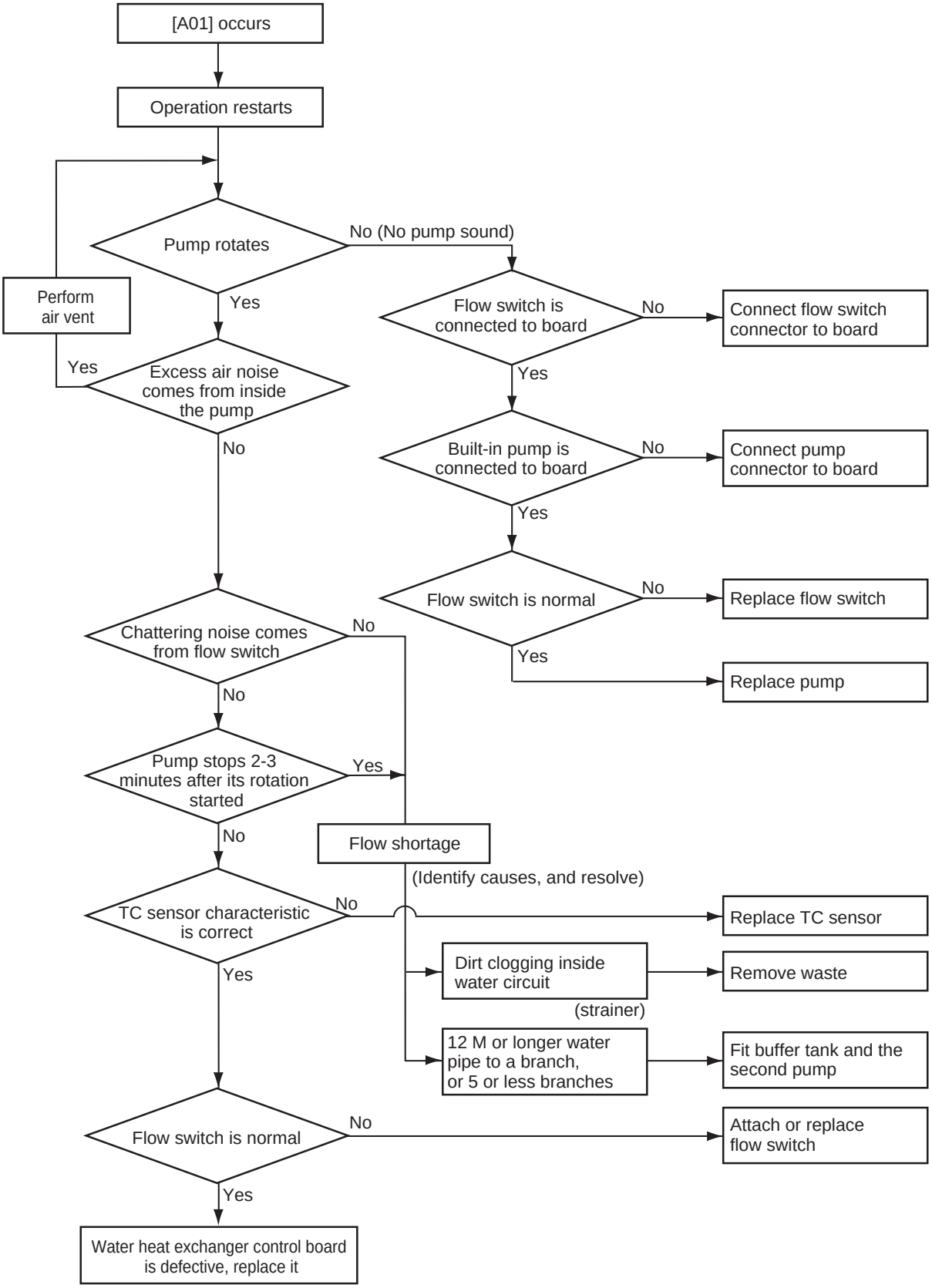
Defect mode detected by the remote control

Check code	Diagnostic functional operation			Determination and action
	Operational cause	Status of air-conditioning	Condition	
Not displaying at all (cannot operate by the remote control)	**No communication between hydro unit an remote controller** • The remote control wiring is not connected correctly. • The hydro unit has not been turned on.	Stop	–	Defect in the remote control power supply 1. Check the remote controller wiring. 2. Check the remote controller. 3. Check the hydro unit power supply wiring. 4. Check the water heat exchange control board.
E01	**No communication between hydro unit and remote controller** • Disconnection of the crossover between the remote control and the base unit of the indoor unit (detected on the remote control side).	Stop (Automatic reset)	Displayed when the abnormality is detected.	Defect in the reception of the remote control 1. Check the remote control crossover. 2. Check the remote control. 3. Check the hydro power supply wiring. 4. Check the water heat exchanger board.
E02	**Defect in the signal transmission to the hydro unit.** (Detected on the remote control side)	Stop (Automatic reset)	Displayed when the abnormality is detected.	Defect in the transmission of the remote control 1. Check the transmitter circuit inside the remote control. … Replace the remote control.
E09	**Several remote control base units** (Detected on the remote control side)	Stop (The handset continues)	Displayed when the abnormality is detected.	1.2 Check several base units with the remote control … The base unit is only one, and others are handsets.

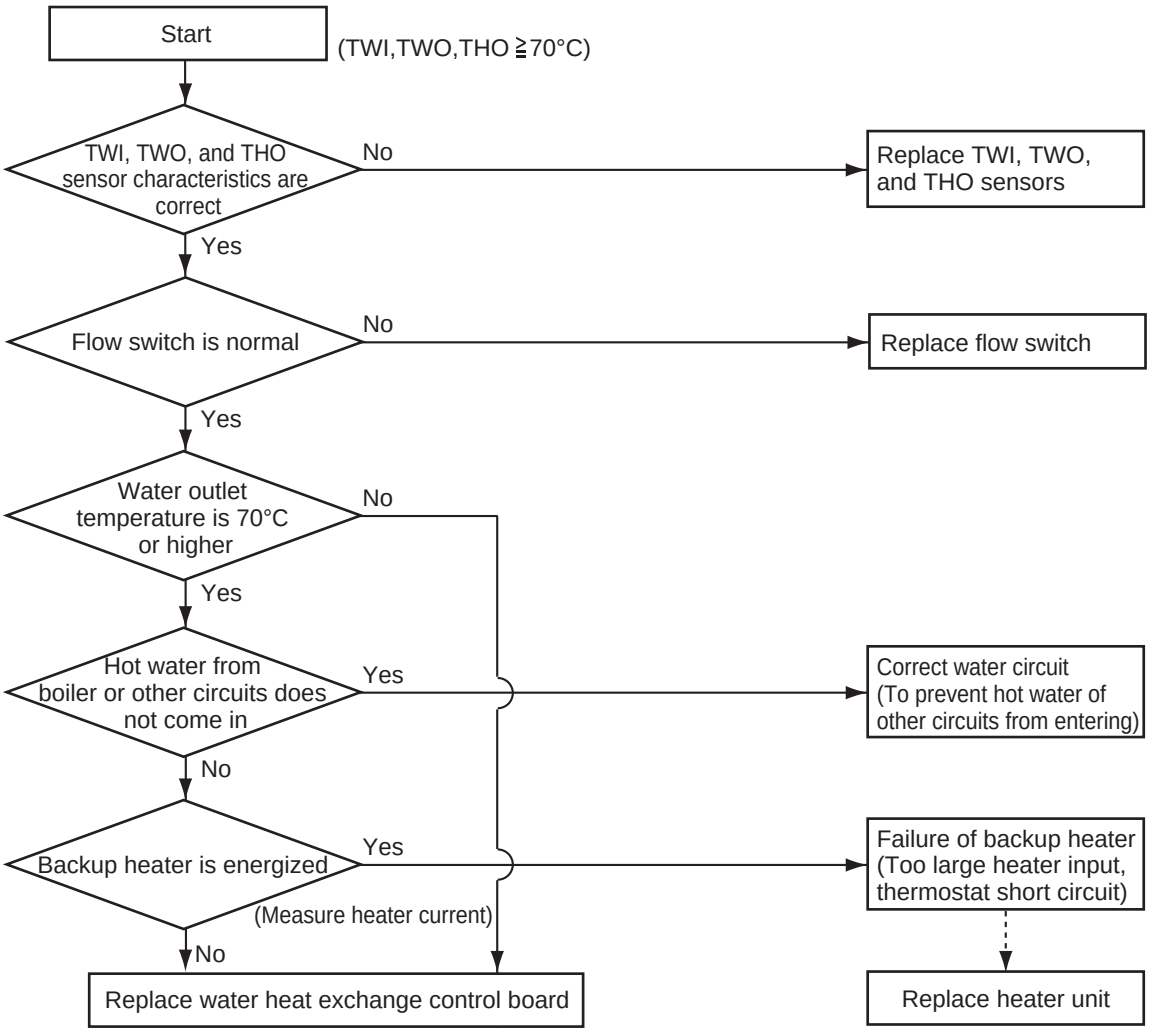
9-4. Diagnosis flow chart for each error code

9-4-1. Hydro unit failure detection

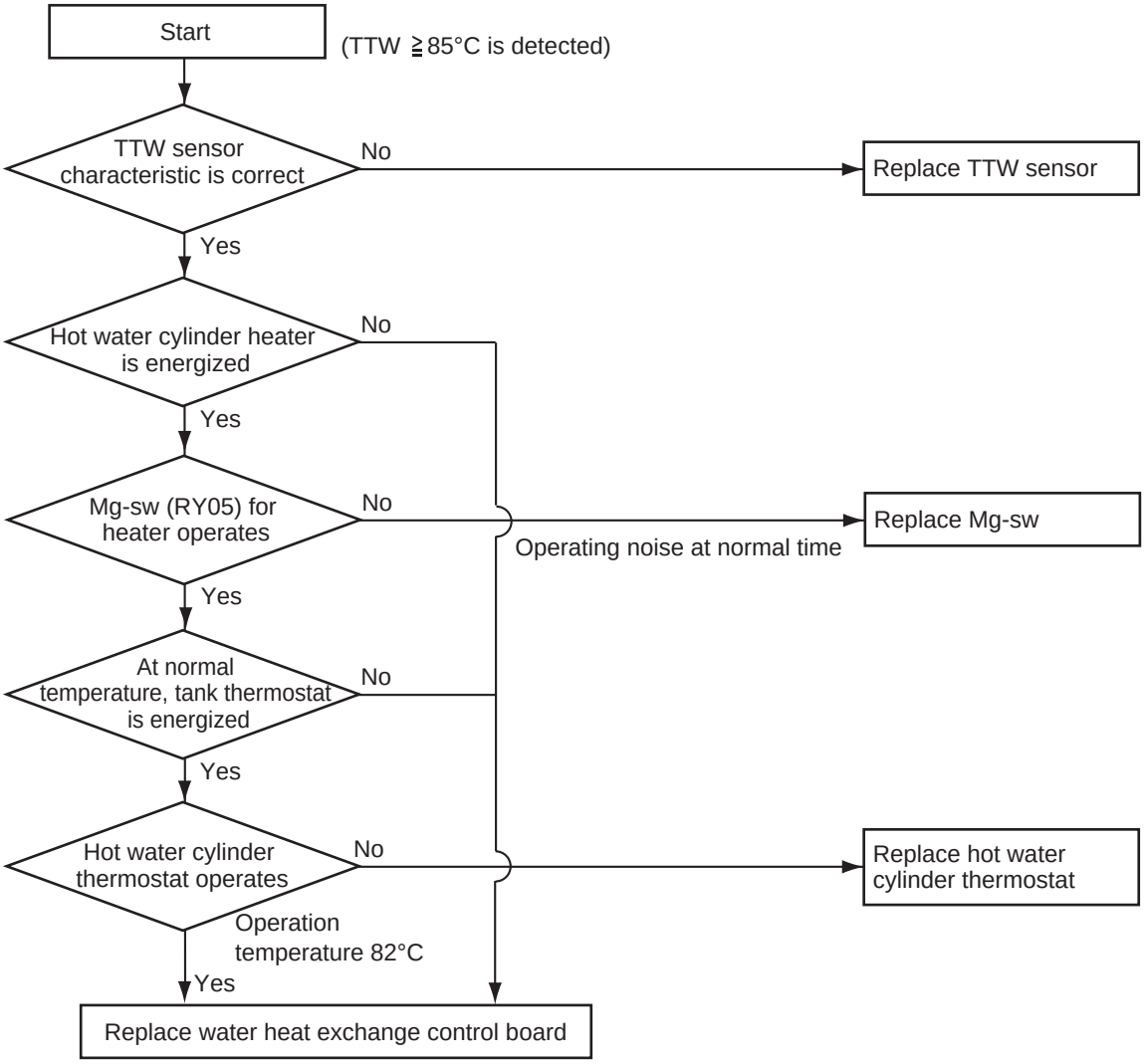
[A01] Error Pump flow determination



[A02] Error Temperature rise and error short circuit

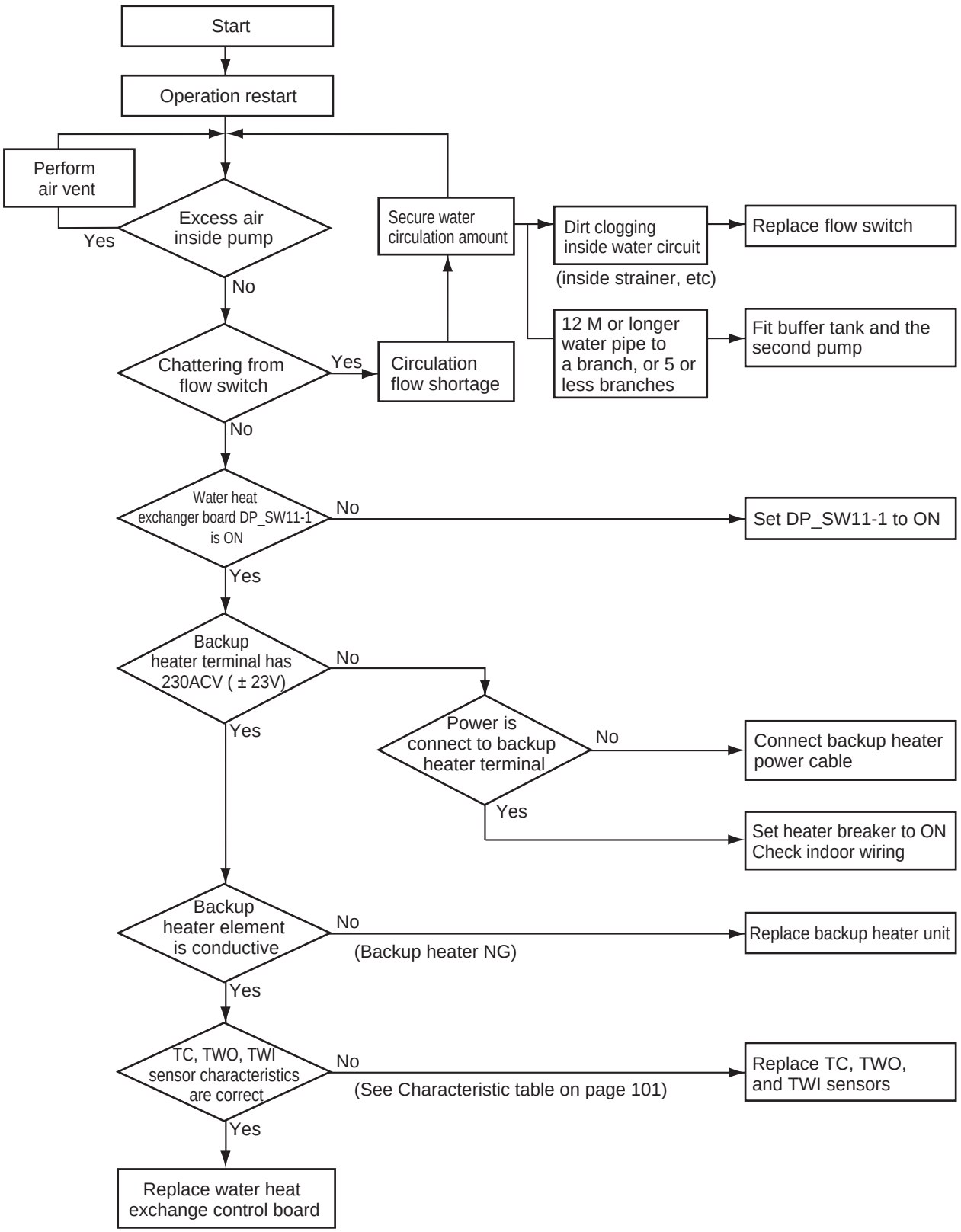


[A03] Error Temperature rise and error short circuit

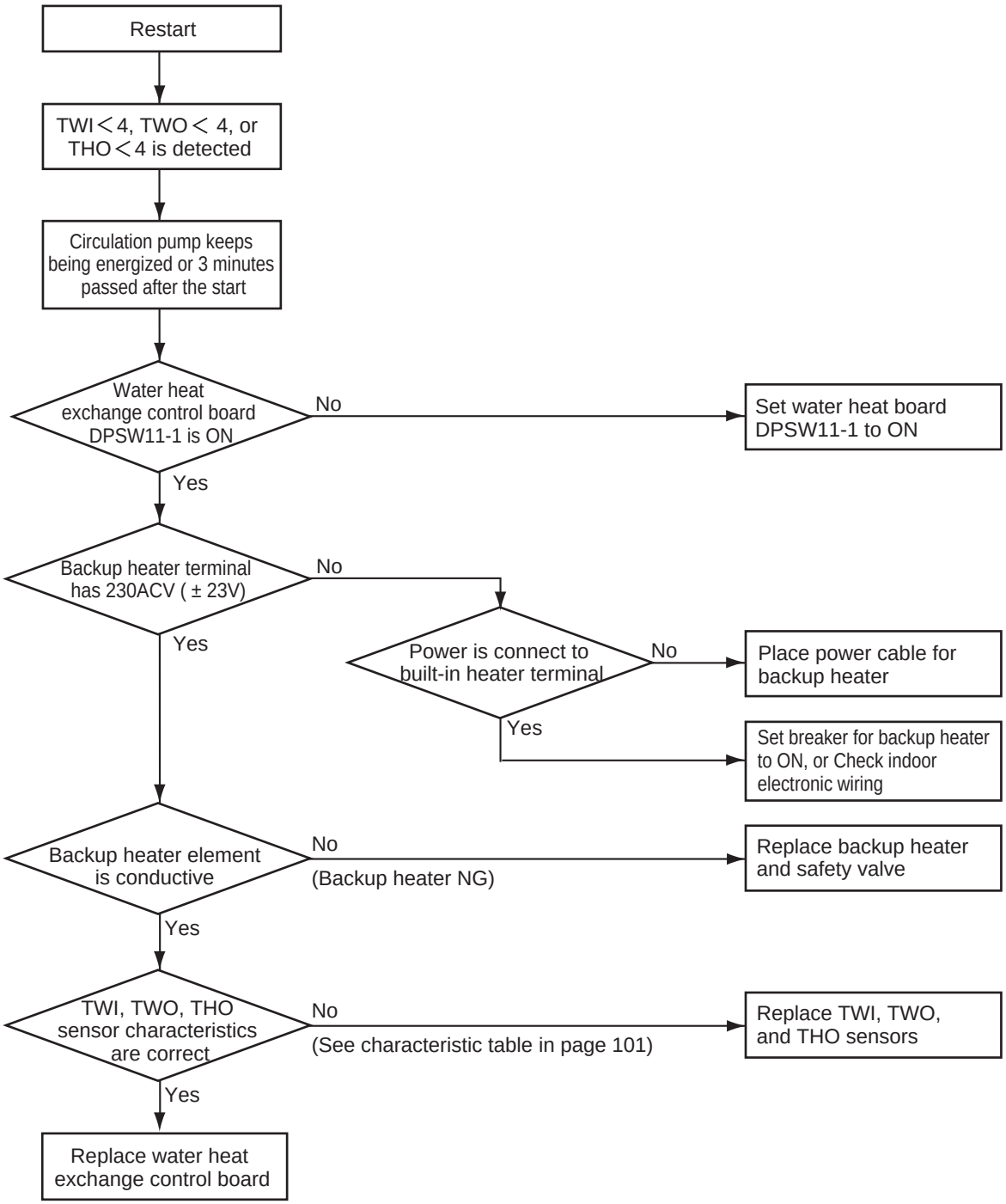


[A04] Error Freeze prevention control

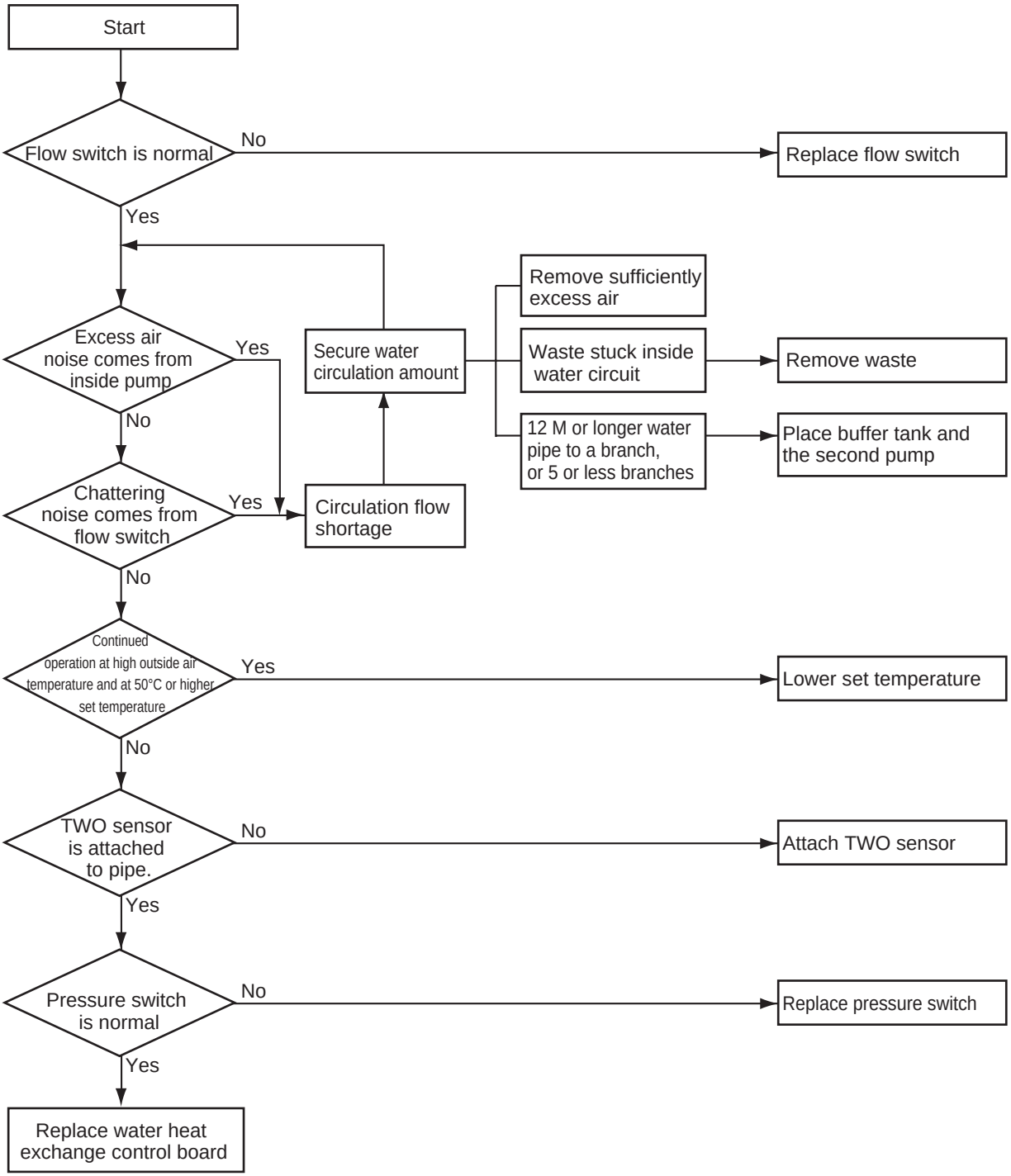
When the outside temperature or inlet water temperature is low (approx. 20°C or lower) and the room load is large (operation frequency ≧ rating), the freeze prevention control may be activated.



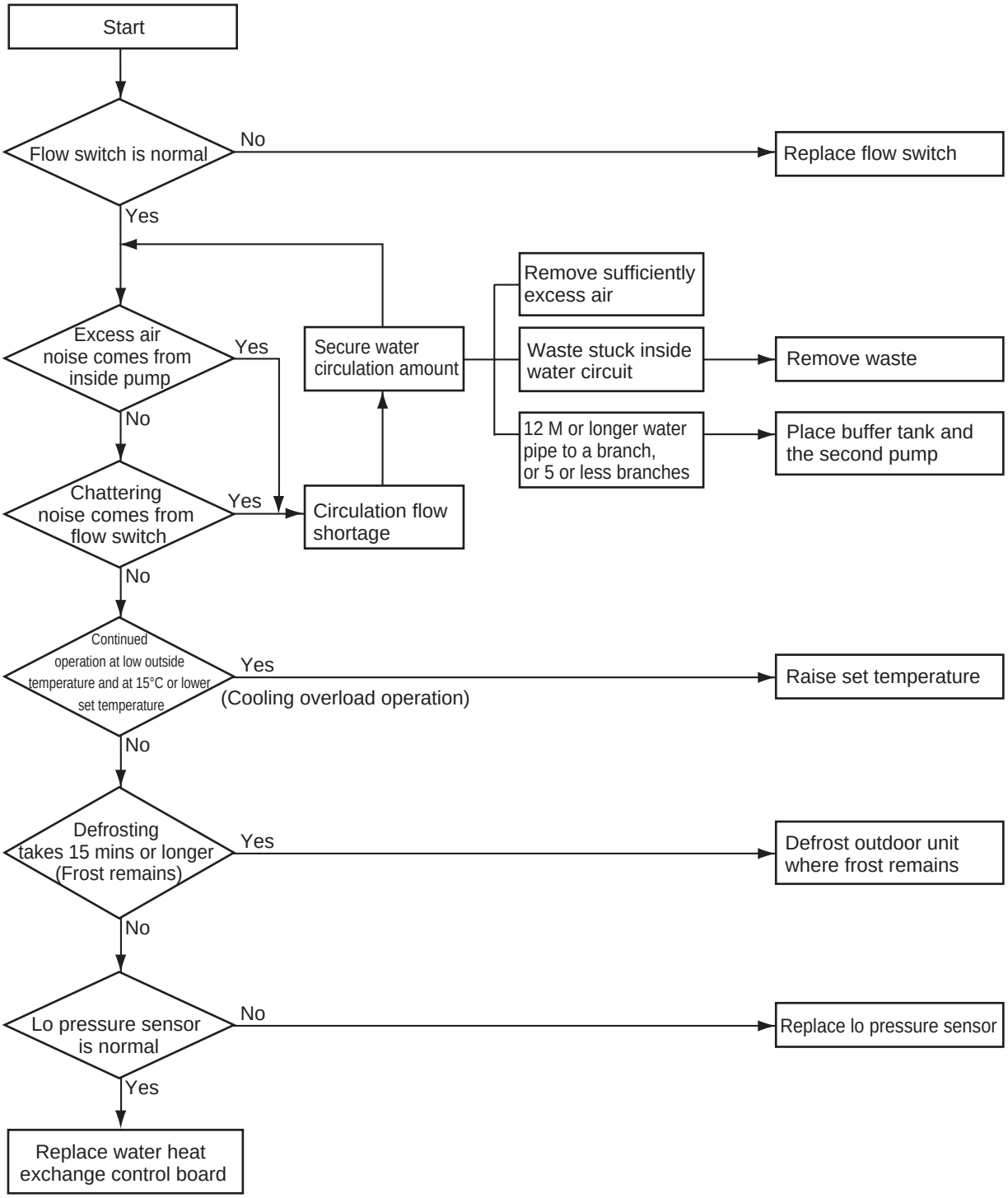
[A05] Error Piping freeze prevention control


Restart
TWI＜4, TWO＜ 4, or THO＜4 is detected
Circulation pump keeps being energized or 3 minutes passed after the start
Water heat exchange control board DPSW11-1 is ON
No
Set water heat board DPSW11-1 to ON
Yes
Backup heater terminal has 230ACV (± 23V)
No
Yes
Power is connect to built-in heater terminal
No
Place power cable for backup heater
Yes
Set breaker for backup heater to ON, or Check indoor electronic wiring
Backup heater element is conductive
No
(Backup heater NG)
Replace backup heater and safety valve
Yes
TWI, TWO, THO sensor characteristics are correct
No
(See characteristic table in page 101)
Replace TWI, TWO, and THO sensors
Yes
Replace water heat exchange control board

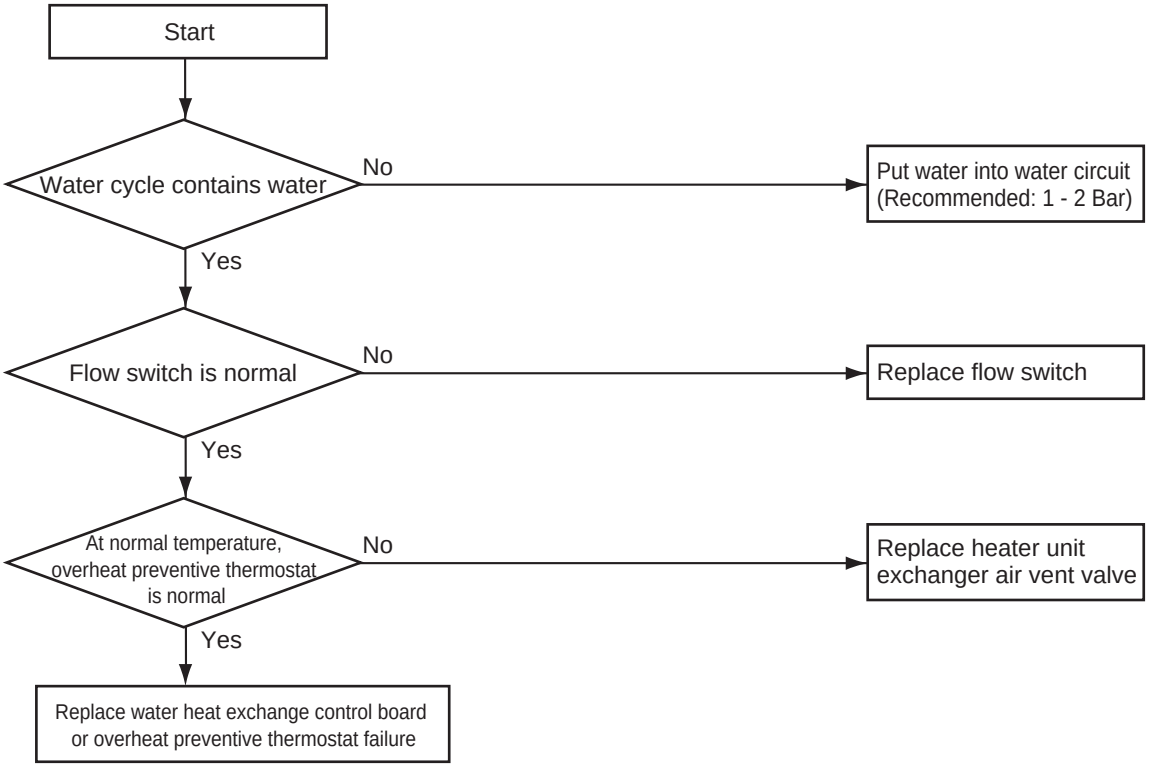
[A07] Error Pressure switch operation (Hot water supply/Heating operation)



[A08] Error Lo pressure sensor lowering operation failure (Cooling/Defrosting operation)

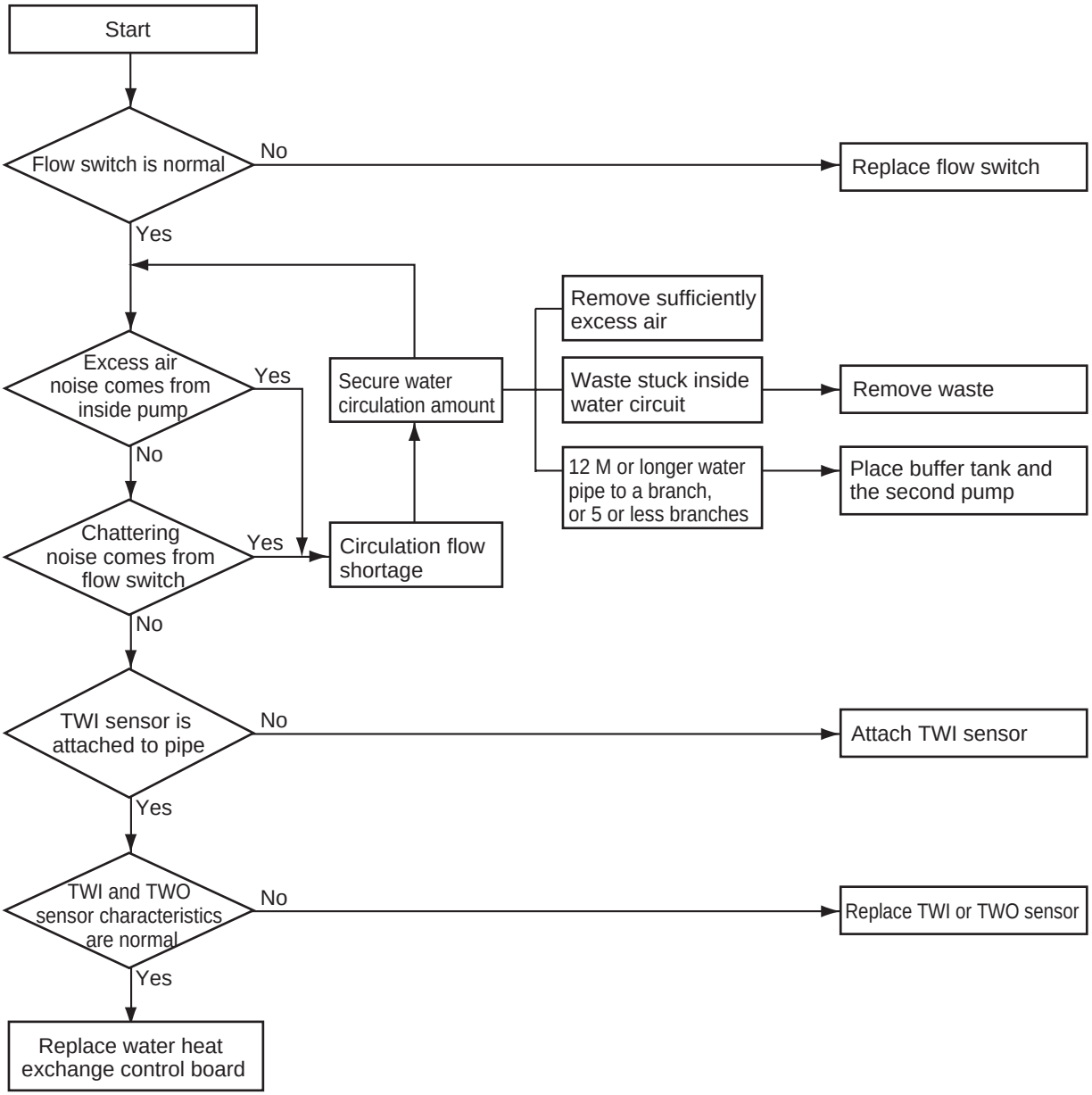


[A09] Error Overheat prevention thermostat failure (Hot water supply/Heating operation)

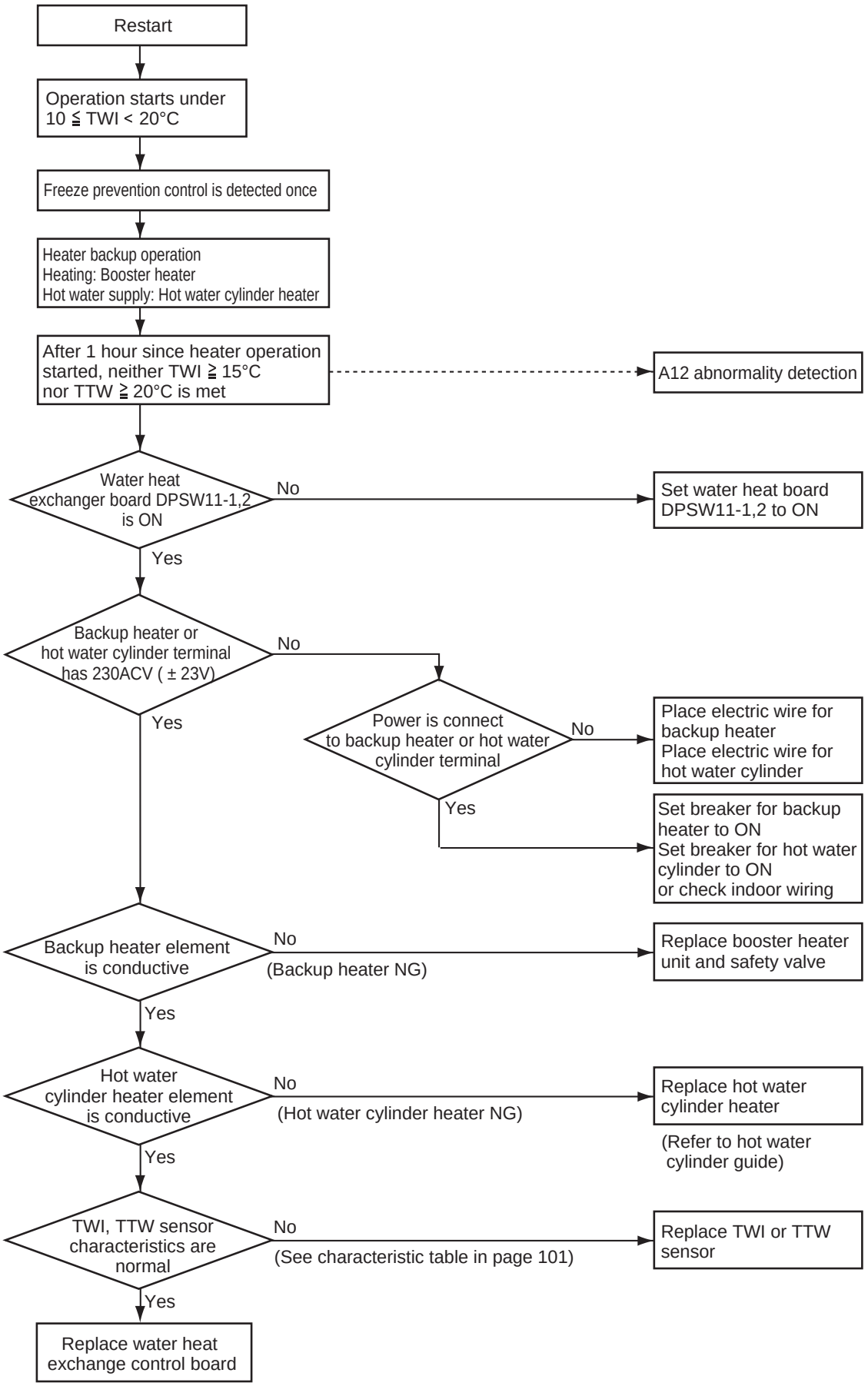


*Replace water heat exchange control board or overheat preventive thermostat failure: After the control board is replaced, if the same operation repeats, the overheat preventive thermostat is determined as defective (does not operate at 75°C).

[A11] Error Release protection operation



[A12] Error Heating or Hot water supply heater failure


Restart
Operation starts under 10 ≦ TWI < 20°C
Freeze prevention control is detected once
Heater backup operation
Heating: Booster heater
Hot water supply: Hot water cylinder heater
After 1 hour since heater operation started, neither TWI ≧ 15°C nor TTW ≧ 20°C is met
A12 abnormality detection
Water heat exchanger board DPSW11-1,2 is ON
No
Set water heat board DPSW11-1,2 to ON
Yes
Backup heater or hot water cylinder terminal has 230ACV (± 23V)
No
Power is connect to backup heater or hot water cylinder terminal
No
Place electric wire for backup heater
Place electric wire for hot water cylinder
Yes
Set breaker for backup heater to ON
Set breaker for hot water cylinder to ON
or check indoor wiring
Yes
Backup heater element is conductive
No
(Backup heater NG)
Replace booster heater unit and safety valve
Yes
Hot water cylinder heater element is conductive
No
(Hot water cylinder heater NG)
Replace hot water cylinder heater
(Refer to hot water cylinder guide)
Yes
TWI, TTW sensor characteristics are normal
No
(See characteristic table in page 101)
Replace TWI or TTW sensor
Yes
Replace water heat exchange control board